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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

WATER RESOURCES OF GEORGIA

BY

B. M. HALL AND M. R. HALL

WASHINGTON
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ATHAM
OCEAN
ATLANTIC
81°
30°
81°

WATER RESOURCES OF GEORGIA.

By B. M. HALL and M. R. HALL.

INTRODUCTION.

It is the purpose of this publication to present in a single volume the large amount of data relating to the flow and power of Georgia streams resulting from the work of the water resources branch of the United States Geological Survey, which was begun in the year 1895. These data consist essentially of gage heights and discharge measurements that can be used to show the continuous daily flow of the streams, and of certain river profiles, in the form of tabulated elevations of water surface at points along the river, that can be used to estimate the available fall at any place. The amount of water flowing in the stream and the fall which can be used will determine the amount of power which can be developed. A quick formula to use is as follows: $\frac{\text{Flow in sec.-ft.} \times \text{fall in feet}}{11}$ =net horsepower on water wheel, realizing 80 per cent of the theoretical power.

TOPOGRAPHY AND GEOLOGY.

GENERAL FEATURES.

A systematic study of the water powers of the State requires a knowledge of the drainage systems, which are somewhat intricate.

The topography of the State is peculiar. Chattahoochee Ridge, which runs from the northeast corner of the State in a southwesterly and southerly direction through Gainesville, Atlanta, Griffin, Fort Valley, Fitzgerald, and through the Okefenoke Swamp to the Florida line, divides the waters of the Atlantic Ocean from the waters of the Gulf of Mexico and forms the backbone of the State. The great drainage basins on the Atlantic slope are the Savannah, the Ogeechee, the Altamaha, the Satilla, and the St. Marys. Those draining into the Gulf are the Suwanee basin, including Suwanee River and tributaries; the Ochlockonee basin, emptying into Ochlockonee Bay; the Apalachicola basin, including Chattahoochee and Flint rivers, emptying at Apalachicola, Fla.; the Mobile basin, or Coosa River

system, draining to Mobile, Ala.; and the Tennessee basin, including Hiwassee, Nottely, and Toccoa (Okoee) rivers, which flow through Tennessee and Mississippi rivers, emptying into the Gulf at New Orleans. The last basin is cut off from all the others by the Blue Ridge Mountains, which run across the northern end of the State. Some idea of the diversity of drainage may be had from the statement that there are three springs in northeast Georgia within a stone's throw of each other that send out their waters to Savannah, Ga., to Apalachicola, Fla., and to New Orleans, La.

The streams of the Savannah, Altamaha, Apalachicola, Mobile, and Tennessee basins begin in, and have a large part of their territory lying in, the crystalline or granitic region, which is all that part of the State lying north of the southern fall line, and east of the western fall line. The streams of these drainage basins rise at elevations from 900 to 2,000 feet above sea level and flow along the high Piedmont Plateau in a succession of cascades until they come to the fall line, where they take their last leap from the granitic bed rock to the navigable waters of the younger geologic formations.

The southern fall line passes through Augusta, Milledgeville, Macon, and Columbus, and marks the ancient Atlantic coast line and the present division between the crystalline and Cretaceous geologic formations. Along this line, which is practically parallel to the Blue Ridge Mountains, the Cretaceous lies unconformably upon gneiss, the surface of which slopes toward the sea at a steep angle, and gives unmistakable evidence of having formed at one time a barren rocky seacoast similar to that of Massachusetts.

The western fall line passes through Carters on Coosawattee River and Cartersville on Etowah River and marks the ancient coast line of the Gulf of Mexico or Paleozoic Sea and the present division between the crystalline and Paleozoic geologic formations. The conditions along this fall line have no similarity to those along the southern fall line. The formations, both crystalline and Paleozoic, have been wrinkled, folded, and faulted by lateral pressure to such an extent that no contact slope exists between the two formations along which percolation could take place. Etowah River below Cartersville shows a hard blue limestone bed rock, out of which many bold springs flow into the river, and while the best shoal on the river is at Cartersville in the crystalline bed rock just above the fall line, the river is a series of shoals all the way down to Rome, where it unites with the navigable Oostanaula to form Coosa River.

The western fall line crosses the Coosawattee in Murray County at Carters, which is the head of navigation. The country along the Coosawattee below Carters is mainly a pervious shale that drinks up most of the smaller streams in driest weather. Although very large limestone springs having a good flow at all seasons abound, yet

uring long dry spells the streams from most of them become smaller nd smaller as the distance from the fountain head increases, and nally soak into the ground and disappear.

From the foregoing discussion it will be seen that the largest and ıost important water powers of the State are in the crystalline area orth of the southern fall line and east of the western fall line. It ⁄ill be convenient, therefore, in this discussion to divide the State ydrographically into three areas: (1) The crystalline area in middle nd northeastern Georgia as above defined; (2) the Paleozoic area ı northwest Georgia, and (3) the coastal plain lying south of the outhern fall line and embracing more than half the State.

THE CRYSTALLINE AREA.

The crystalline area embraces the Blue Ridge Mountain region, ⁄ith elevations from 1,000 to 4,800 feet above sea level, and the Piedıont Plateau, with elevations from 600 to 1,600 feet above sea level. 'he rivers of the Piedmont Plateau in this region rise at very high ltitudes and flow over granite, gneiss, etc., with precipitous falls ı successions of shoals and eddies, between high hills, affording xcellent sites for dams and canals, and are peculiarly adapted to he development of high-head water powers, with a good and contant water supply. The following table shows the fall on the main ivers that cross the fall lines in the State:

Fall on Georgia rivers.

River.	Distance.	Fall.
	Miles.	*Feet.*
avannah, above Augusta	64	257
conee, above Milledgeville	54	211
cmulgee, above Macon	50	219
lint, above fall line	45	334
hattahoochee, above Columbus	35	368
towah, above Cartersville	17	118
oosawattee, above Carters	24	583

The above table gives an idea of the fall to the mile on the main ivers of the lower part of the Piedmont Plateau. The upper secions of these streams and of their tributaries are even more precipious. Some shoals on tributaries are as follows:

Broad River, 63 feet in 2 miles.

Tallulah River, 525 feet in 2⅔ miles.

Towaliga River, 96 feet in 1,200 feet.

Neither the rivers nor their tributaries have any regularity in fall; ; is concentrated in shoals over hard ledges of granite or gneiss, with ong stretches of gentle flow between. These streams will be considred in detail in the body of this report, and each shoal of importance ⁄ill be mentioned.

THE PALEOZOIC AREA.

The Paleozoic area lies from 400 to 1,000 feet above sea level. The only river in it with much fall is the Etowah, which at Cartersville crosses the fall line from crystalline bed rock to limestone. Between this point and Rome the shoals are caused by harder limestone ledges, the total fall being 109 feet in 46 miles. The tributaries of this river, together with those of the Conasauga, Oostanaula, Coosa, and Tennessee, furnish a large number of small water powers that are valuable for local enterprises, as they are mainly in rich agricultural districts. The entire area abounds also in large springs that can be relied on to furnish a pure and unfailing water supply for municipal and industrial purposes.

THE COASTAL PLAIN.

The elevation of the Coastal Plain varies from tide water up to 500 feet above sea level. The large rivers from the crystalline belt cross the southern fall line into this area at the following elevations above sea level:

Elevation of rivers at southern fall line.

	Feet.
Savannah, at Augusta	98
Oconee, at Milledgeville	215
Ocmulgee, at Macon	280
Flint, at fall line	327
Chattahoochee, at Columbus	190

Four of these rivers are rated as navigable streams below the points mentioned. The Savannah and Chattahoochee have regular steamboat lines to these points, but the Oconee and Ocmulgee will require considerable Government work before they can be navigated to Milledgeville and Macon, respectively. Flint River is shoaly all the way to Albany. It is the only one of these rivers that can be counted on for any water power in this area, but on smaller streams there are hundreds of good powers well distributed, many of which are already developed for local uses.

This part of Georgia is developing more rapidly as an agricultural and fruit-raising region than is any other part of the State. Its pine forests are still a great source of wealth, but land that has yielded its full crop of turpentine and timber is proving more valuable for cotton, corn, watermelons, cantaloupes, pecans, pears, peaches, garden vegetables, and Georgia cane sirup. The climate is mild and healthful, the streams are bold and constant, and the supply of artesian water is abundant and of the best quality.

USES OF WATER.

IRRIGATION.

In the arid region of the Western States, where the rainfall is not sufficient or is not properly distributed through the year for making crops, the most important use of water is for irrigation. In Georgia and other Southern and Eastern States the rainfall is much greater and more evenly distributed through the year, but, nevertheless, the lack of rain at the proper time often cuts a crop to one-half or one-third what it would have been with one additional wetting at the time most needed. Thus a small amount of water in storage and ready for use will do more good in the East, where it has the help of frequent rains through a large part of the crop season, than will a much greater amount of water in the arid West, where artificial irrigation must be depended on exclusively.

Market gardening is one of the most attractive and most profitable agricultural pursuits in the South, but irrigation is almost a necessity for making the business a safe one. In any event, it can be relied on to double the yield of one crop and to enable the gardener to make from two to three crops on the same land in the same year. In Georgia the gardening season is ordinarily from February to July, but with irrigation it can be extended to November and even later. In Florida the gardening season is in winter, from November to April. This is the dry season, but the planters irrigate from flowing artesian wells and ship celery, lettuce, and other vegetables all winter. This system is being rapidly introduced in southern Georgia.

Artesian wells are the ideal source of water for individual irrigation plants where they can be had at small expense and where the supply is sufficient.

Gravity systems by means of storage dams and canals are more extensive in their application and are practicable on the lowlands of river and creek valleys having adjacent hill country from which tributaries flow at a higher elevation. These tributaries can be impounded by large storage dams, and small canals can be cut along the hillsides near the foot of the hills to furnish water for irrigating the lowlands. A small stream, properly stored, can be made to irrigate a large area in this way, as one good wetting at the proper time is all that a crop is likely to need.

Hydraulic rams, which are now manufactured of large capacity, can be relied on for pumping water to any desired elevation for irrigating high lands. Some plants of this kind are now in use in Georgia and are giving good results. The water is pumped up by the ram into a large reservoir excavated on a clay hill or made by a dam in a high ravine. The water thus accumulated for months is held until needed and is run through open ditches onto the fields below the

reservoir level. A small stream having a flow of 80 gallons a minute and a fall of 20 feet will operate a ram that will pump 15,000 gallons a day to a height of 100 feet above the ram. This amount of water, stored as suggested, will furnish all necessary irrigation to 10 or 12 acres in this State.

A ram of this size takes its water through a 4-inch drive pipe. Rams are made in all sizes, from a 1-inch ram using 3 gallons a minute to a duplex 12-inch ram using two 12-inch drive pipes and a water supply of 1,500 gallons a minute. One of the latter placed on a stream having a flow of 1,500 gallons a minute, which is a very small creek, will utilize a shoal of 20 feet and pump 288,000 gallons a day to a height of 100 feet above the ram. Such creeks are found in all parts of the crystalline region and are plentiful in the hilly parts of the Paleozoic area and of the Coastal Plain. Any amount of fall from 4 feet up to 40 feet can be utilized, the amount of water pumped being directly as the drive head and inversely as the lift. These improved rams open up great possibilities for cheap water supply. Their first cost is very moderate, and they pump by water power, requiring no attendant.

Near the coast, where the streams have very little fall, the agricultural lands are on a low level, from 5 to 15 feet above the streams, and the supply of pine wood for fuel is abundant. Under these conditions centrifugal steam pumps can be run very economically to give abundant water for irrigation.

USE OF WATER FOR DOMESTIC PURPOSES AND MUNICIPAL SUPPLY.

Pure drinking water is abundant in all parts of the State. In north and middle Georgia it is obtained from wells, springs, and pure streams. Farther south the best supply is from artesian wells. Most of the large cities of north and middle Georgia get their supply from rivers. Atlanta uses filtered water from the Chattahoochee; Augusta from the Savannah; Macon from the Ocmulgee, and other cities of the region from rivers or local creeks. Savannah, Albany, Americus, Thomasville, Dublin, and other south Georgia municipalities get their supply from artesian wells. In country and suburban communities hydraulic rams are largely used for dairy farms and other domestic supplies. There are also many gravity systems in the mountains and artesian wells in the coastal plain.

USE OF WATER FOR INDUSTRIAL PURPOSES.

The supply of water for mining, quarrying, manufacturing, steam making, etc., is very important.

Gold mining is a great industry in the State, and water is largely used for hydraulic work in placers and also in saprolite belts. In

the latter class of mining, the water excavates and transports the material in long flumes, automatically depositing the loose gold in the sluice riffles, separating the slate, clay, and slimes from the quartz, and landing the concentrated ore in the mill, where it is crushed by stamps. The free gold is amalgamated on copper plates, and the auriferous iron sulphides are saved on a concentrator and reduced by chlorination and precipitation of the gold. All of these processes require large quantities of water. In the Dahlonega region water for hydraulic mining is brought long distances in open canals along the hillsides and hilltops. Some of these canals are 40 miles and more in length and have cost many thousands of dollars. One of the most famous is the Yahoola ditch from the upper waters of Yahoola Creek. It is 20 miles long from its head to the town of Dahlonega and has supplied mines through branch ditches 10 and 15 miles in length. It carries from 500 to 1,000 miner's inches of water, and water has been sold from it for many years at 12 cents per miner's inch per day. A miner's inch, Colorado standard, is 11¼ gallons, or 1½ cubic feet per minute, or one-fortieth of a cubic foot per second.

In a large part of the extensive gold regions of the State the mining is underground work in which water is not used for excavation, but a large amount of battery water is used in the mills, and an additional supply is needed for the concentrators.

Water is also used extensively in the washing and concentrating processes of iron, manganese, ocher, barytes, pyrites, corundum, asbestos, bauxite, and other minerals.

Quarrying industries require a good water supply, both for making steam and for operating rock drills. The marble quarries near Tate, Marble Hill, and Ball Ground, in Pickens County; the granite quarries at Stone Mountain, Lithonia, Conyers, Lexington, Elberton, and other points; the National Cement Quarries at Cement, Ga., near Kingston; the slate and limestone quarries of the Southern States Portland Cement Company at Rockmart; and other quarries throughout the State are operated on a large scale.

Immediately allied with the quarrying industry are the great marble manufacturing mills at Tate, Marble Hill, Nelson, Ball Ground, Canton, and Marietta for sawing and finishing marble. The sawing and rubbing is done with sand and water, requiring a good water supply. Aside from the water required for power, there are many manufacturing industries, such as paper making and bleacheries, that can not be operated without pure water and a great deal of it.

There are many large springs in the Paleozoic region of northwest Georgia and also in the Coastal Plain of south Georgia that are clear and sparkling and excellent for drinking purposes, but that contain carbonates of lime and magnesia in solution, either of which is objectionable in a water to be used in chemical processes such as

bleaching; if present in large quantities they even render the water unfit for steam boilers, as they deposit incrustations of lime and magnesia on the inside of the boiler. The springs of the crystalline region of middle and northeast Georgia are generally pure, containing no carbonates and a very insignificant amount of the other mineral ingredients, but in the greater part of this area the springs are small, rarely having a flow of more than 10 or 15 gallons a minute. The exception to this rule is a belt of country within the crystalline region, running nearly east and west along the pine mountain range in Pike, Upson, Meriwether, Talbot, and Harris Counties, in which there are large springs of pure freestone water, suitable both in quantity and quality for bleacheries, fish hatcheries, etc. One of the largest of these is the Cold Spring, in Meriwether County, at Bullochville, about 1 mile below Warm Springs, Ga., on the Georgia Midland division of the Southern Railway. It has a flow of 2,025 gallons per minute, and is utilized as a fish hatchery by the United States Fish Commission. It issues from a ledge of vitrified sandstone, which is continuous through the entire region, and forms the backbone of the pine mountain range, which is geologically the coast range of Georgia. Warm Spring, about 1 mile distant, has a flow of 1,890 gallons a minute, but is evidently of a much deeper origin, as its temperature is 87° Fahrenheit. There are many other springs of the same character as Cold Spring along the pine mountain belt, one of the most prominent of which is Big Blue Spring, in Harris County, which has been proposed as a water supply for the city of Columbus.

In other parts of the State probably one of the best sources of pure, clear water for chemical use is found in the gravel beds underlying the river bottom land. These gravel beds lie immediately on the bed rock and can generally be relied on to furnish a good supply of water that has been clarified by a natural filter.

WATER SUPPLY OF STREAMS.[a]

MEASUREMENT OF FLOW.

In order to obtain a knowledge of the water supply, or amount of water flowing in the streams at all seasons, certain convenient stations have been established on important rivers and tributaries.

A gage for observing the stage of the river is established at a bridge or other place where the record of flow is to be made. This gage is a vertical staff, or some other device by which the height of water may be observed, and is read each day by a person living near by. The

[a] The methods by which the records of stream discharge have been made by the United States Geological Survey are described in detail in Water-Sup. and Irr. Papers Nos. 94 and 95.

average of the gage readings, if more than one, in any day is used as the mean gage height for that day.

At various stages of the river one of the hydrographers of the Survey visits the station and measures with a current meter the amount of water flowing. This meter is primarily an instrument for measuring the velocity of moving water, and consists essentially of a wheel with vanes, which may be shaped like those of a windmill or of a screw, or with cups like those of an anemometer, the necessary qualification being that moving water shall readily cause the wheel of the meter to turn. Each meter is rated before use. The rating is done by moving the meter through still water at various observed speeds to determine the relation between the velocity with which the meter moves through the water and the revolutions of the wheel. This relation having been determined, the meter is used in running water, the revolutions per unit of time noted, and the velocity of the water computed.

Observations of depth of water are also made, and from them the area in cross section of each portion of the stream is computed; each partial area multiplied by the mean velocity of that area gives a partial discharge; the sum of the partial discharges is the total discharge of the stream.

Measurements of flow as outlined above are made covering a considerable range of gage height. They are then plotted on coordinate paper, with gage heights for ordinates and discharges for abscissas, and a smooth curve, called the rating curve, is drawn through the points. From this curve a rating table is made which shows the discharge of the stream for any gage height.

The data necessary for the construction of a rating table for a gaging station as just stated are (1) the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current and the quantity of water flowing, and (2) a thorough knowledge of the conditions at and in the vicinity of the station.

The construction of the rating table depends on the following laws of flow for open permanent channels: (1) The discharge will remain constant so long as the conditions at and near the gaging station remain constant; (2) neglecting the change of slope due to the rise and fall of the stream, the discharge will be the same whenever the stream is at a given stage; (3) the discharge is a function of, and increases gradually with, the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number

of discharge measurements to cover the range of the stage of the stream.[a]

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor alone will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends on the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor.

This curve may be a straight line, or a curve either convex or concave, or may be a combination of these three forms, owing to the relative degree to which any of the factors are present or to the change which they undergo during the change of gage height. A careful study of the conditions at a gaging station makes it possible to predict the form of this curve and to extend it beyond the limits of the actual measurements.

The discharge curve is defined primarily by the measured discharges, and when these do not cover the entire range of gage height for which it is desired to make a rating table, the curve is sometimes extended by the use of the area and mean-velocity curves, which have themselves been extended, as above shown. This curve, under normal conditions, is concave toward the horizontal axis and is generally parabolic in form.

In preparing the rating table the discharge for each tenth on the gage is taken from the curve, and the differences between successive discharges are then adjusted according to the law that they shall be either increasing or constant. The finished rating table shows the discharge in cubic feet per second, corresponding to each tenth of a foot on the gage, and is used to supply the discharge values to the daily gage heights furnished by the observer in making up the daily or monthly estimate of flow.

DEFINITIONS.

The volume of water flowing in a stream, the "run-off," is expressed in various terms, each of which is associated with a certain class of work. These terms may be divided into two classes: Those which represent a rate of flow, as second-foot, gallons per minute, and run-off in second-feet per square mile, and those which represent actual quantities of water, as run-off in depth in inches. They may be defined as follows:

[a] A typical rating curve, with corresponding area and mean-velocity curves, is given in Water-Sup. and Irr. Paper No. 168, 1906, p. 17.

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at the rate of 1 foot per second. It is generally used as a fundamental unit from which the others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed over the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

EXPLANATION OF TABLES.

For each regular station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height tables.
4. Rating tables.
5. Tables of estimated monthly and yearly discharges and run-off, based upon all the facts available to date.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station. They also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would affect the use of the data collected.

The discharge-measurement table gives the results of the discharge measurements made during each year, and includes the date, the gage height, and the discharge in second-feet.

The table of daily gage heights gives for each day the mean height of the surface of the river, as found from the mean of the gage readings taken on that day.

The rating table gives discharges in second-feet corresponding to each stage of the river, as given by the gage heights.

In the table of estimated run-off the column headed "Maximum" gives the mean flow for the day when the mean gage height was the highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise,

in the column of "Minimum," the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" gives the average flow for each second during the month. Upon this mean the computations for the remaining columns are based.

GAGING STATIONS IN GEORGIA.

The gaging stations maintained in Georgia are listed below:

Tallulah River at Tallulah Falls.
Tugaloo River near Madison, S. C.
Savannah River near Calhoun Falls, S. C.
Savannah River at Woodlawn, S. C.
Savannah River at Augusta.
Chauga River near Madison, S. C.
Seneca River near Clemson College, S. C.
Rocky River near Calhoun Falls, S. C.
Broad River (of Georgia) near Carlton.
Broad River (South Fork) near Carlton.
Ogeechee River near Millen.
Williamsons Swamp Creek at Davisboro.
Cannoochee River near Groveland.
South River near Lithonia.
South River near Snapping Shoals.
Ocmulgee River near Flovilla.
Ocmulgee River at Macon.
Yellow River near Stone Mountain.
Yellow River at Almon.
Alcovy River near Covington.
Alcovy River near Stewart.
Towaliga River near Juliette.
Middle Oconee River near Athens.
Oconee River at Barnett Shoals.
Oconee River near Greensboro.
Oconee River at Carey.
Oconee River at Fraleys Ferry, near Milledgeville.
Oconee River at Milledgeville.
Oconee River at Dublin.
Apalachee River near Buckhead.
Ohoopee River near Reidsville.
Chattahoochee River near Cornelia.
Chattahoochee River near Gainesville.
Chattahoochee River near Buford.
Chattahoochee River near Norcross.
Chattahoochee River near Vinings.
Chattahoochee River at Oakdale.
Chattahoochee River at West Point.
Soque River near Demorest.
Sweetwater Creek near Austell.
Mulberry Creek near Columbus.
Flint River at Molina.
Flint River near Woodbury.
Flint River near Montezuma.
Flint River at Albany.
Big Potato Creek near Thomaston.
Muckalee Creek near Leesburg.
Muckalee Creek near Albany.
Kinchafoonee Creek near Leesburg.
Kinchafoonee Creek near Albany.
Ichawaynochaway Creek at Milford.
Etowah River near Ballground.
Etowah River at Canton.
Etowah River at Rome.
Etowah River near Rome.
Amicalola River near Ballground.
Long Swamp Creek near Ballground.
Coosa River at Rome.
Oostanaula River at Resaca.
Coosawattee River at Carters.
Cartecay River near Cartecay.
Ellijay River near Ellijay.
Mountaintown Creek near Ellijay.
Talking Rock Creek near Carters.
Big Cedar Creek near Cavespring.
Tallapoosa River at Buchanan Bridge, near Tallapoosa.
Tallapoosa River at Adderhold Bridge, near Tallapoosa.

Data for the calendar year 1906 are published in Water-Supply and Irrigation Paper No. 204.

SAVANNAH RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Savannah River is formed by the junction of Tugaloo and Seneca rivers, which unite about 100 miles above Augusta, Ga. It flows in a southeasterly direction, forming the boundary between Georgia and South Carolina, and empties into the Atlantic Ocean near Savannah, Ga. It is navigable up to Augusta, which is at the fall line.

Seneca River is formed by the junction of Little and Keowee rivers, about 5 miles northeast of Seneca, S. C. Both of these tributaries rise in the Blue Ridge in North Carolina and the northwestern part of South Carolina.

Tugaloo River is formed by the junction of Chattooga and Tallulah rivers, which join at the western corner of Oconee County, S. C. It flows in a southeasterly direction and is a part of the boundary between Georgia and South Carolina. Chattooga River rises in Jackson County, N. C., and flows in a southwesterly direction along the boundary between Georgia and South Carolina. Tallulah River rises in Macon County, N. C., and in the northwestern part of Rabun County, Ga., and flows in a southeasterly direction. Parts of its course are cut through the solid rock for hundreds of feet, forming canyons and steep bluffs. Throughout its entire length the fall is very great, and at Tallulah Falls the stream drops more than 500 feet in a short distance.

Broad River joins the Savannah at the southeast corner of Elbert County, Ga. It rises in Habersham and Banks counties and flows in a southeasterly direction to the southeast corner of Madison County, Ga., where the South Fork joins it. From there it flows east to Savannah River. Its drainage is from a rolling country, and there is a considerable amount of fall at various points. At Anthony Shoals the fall is more than 50 feet in a short distance. Above Augusta, Ga., there is much fall, which can be developed for water power. Except at the large plant at Augusta, very little of this is being used.

STREAM FLOW.

TALLULAH RIVER AT TALLULAH FALLS.

This station was originally established August 29, 1900, by M. R. Hall, and records of gage heights were obtained until October 19, 1900. The record was resumed January 18, 1901, and maintained until December 31, 1901. The station was reestablished July 10, 1904, when bench marks were determined and regular gage readings begun. The station is located at the wagon bridge about one-fourth mile above the falls and about the same distance from the village of Tallulah Falls, Ga.

The channel is nearly straight for 300 feet above and 200 feet below the station. The current is swift. Both banks are high, wooded, rocky bluffs and are not subject to overflow. The bed of the stream is composed of rock and is rough and permanent. There is but one channel at all stages.

Discharge measurements are made from the iron wagon bridge, which has a single span of 100 feet and rests on timber piers. The initial point for soundings is the end of the bridge on the upstream side at the left bank.

The original gage is a vertical rod spiked to a small maple tree on the left bank of the river about 50 feet above the bridge. June 21, 1905, a 5-foot rod gage was fastened vertically to the solid rock on the right bank 25 feet above the bridge. The datum is the same as that of the original gage. The gage is read once each day by J. T. McKay. The bench mark consists of a copper plug set in the solid rock on the right bank, 27 feet upstream from the upper edge of the bridge; elevation, 7.05 feet above gage datum.

Discharge measurements of Tallulah River at Tallulah Falls.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1899.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
October 3	0.55	153	June 11	1.20	306
November 25	.75	188	June 13	1.05	295
1900.			July 15	.70	181
August 29	1.00	252	August 22	.92	233
1901.			August 23	.80	218
January 18	1.95	681	September 29	.50	145
February 15	1.85	617	October 28	.40	125
March 4	2.80	1,227	October 28	.41	127
May 22	3.94	2,161	November 23	.77	171
May 23	3.24	1,566	November 23	.75	169
May 23	3.15	1,479	1905.		
July 15	1.58	488	March 3	1.70	471
August 27	3.45	1,601	May 11	1.83	605
September 18	2.80	1,309	May 27	2.10	673
October 19	1.55	506	May 28	2.10	681
1903.			June 21	1.34	375
June 23	1.96	698	June 22	1.77	621
1904.			July 18	2.08	705
March 16	1.65	490	July 18	2.08	683
May 12	1.86	516	September 6	1.15	317
			October 24	.89	228
			November 15	.82	198

Daily gage height, in feet, of Tallulah River at Tallulah Falls.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1900.				1900.				1900.			
1		1.5	1.03	12		0.85	1.01	23		1.25	
2		1.4	1.03	13		.8	1.01	24		1.2	
3		1.1	1.02	14		1.2	1.0	25		1.2	
4		1.0	1.02	15		1.95	1.0	26		1.19	
5		1.0	1.01	16		2.9	1.0	27		1.17	
6		1.0	1.03	17		1.95	1.0	28		1.1	
7		1.0	1.03	18		1.7	1.0	29	1.0	1.09	
8		1.0	1.02	19		1.4	1.0	30	.95	1.04	
9		.9	1.02	20		1.35		31	1.6		
10		.9	1.01	21		1.3					
11		.9	1.01	22		5.4					

Daily gage height, in feet, of Tallulah River at Tallulah Falls—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1	.....	1.9	1.8	2.7	2.4	2.5	2.25	1.4	3.2	1.85	1.4	1.25
2	.....	1.9	1.8	4.95	2.35	2.3	2.2	1.35	3.15	1.85	1.4	1.3
3	.....	2.95	1.75	4.9	2.3	2.2	2.2	1.3	3.1	1.8	1.4	1.3
4	.....	2.4	1.7	2.9	2.25	2.1	2.15	1.3	3.0	1.8	1.4	1.35
5	.....	2.0	1.65	2.85	2.25	2.05	2.1	1.25	3.9	1.8	1.4	1.35
6	.....	2.0	1.6	2.8	2.25	1.95	2.05	6.35	3.85	1.75	1.4	1.3
7	.....	1.95	1.6	2.75	2.2	1.9	2.0	4.25	3.85	1.75	1.4	1.3
8	.....	2.2	1.6	2.7	2.15	1.8	2.0	3.15	3.75	1.7	1.35	1.3
9	.....	2.2	1.6	2.6	2.1	1.8	1.95	2.75	3.7	1.7	1.35	1.3
0	.....	2.1	1.95	2.55	2.05	1.75	1.9	2.05	3.7	1.7	1.35	1.3
1	.....	2.0	2.1	2.45	2.0	1.75	1.9	1.9	3.6	1.65	1.35	1.4
2	.....	1.95	1.95	2.4	2.0	1.7	1.85	1.8	3.6	1.65	1.35	1.4
3	.....	1.95	1.7	2.6	1.85	1.8	1.8	1.9	3.5	1.65	1.35	1.35
4	.....	1.95	1.65	2.5	1.85	2.1	1.7	6.85	3.5	1.65	1.35	2.8
5	.....	1.9	1.65	2.4	1.8	2.0	1.6	3.9	3.4	1.65	1.3	2.8
6	.....	1.85	1.6	2.3	1.75	2.1	1.6	4.3	3.35	1.6	1.3	2.75
7	.....	1.85	1.55	2.2	1.75	2.2	1.55	5.4	3.25	1.6	1.3	2.75
8	1.95	1.85	1.55	2.1	1.7	2.4	1.55	3.4	3.1	1.6	1.3	2.7
9	1.9	1.85	1.5	5.5	1.9	2.5	2.0	3.15	2.9	1.6	1.35	2.7
0	1.9	1.8	1.5	5.5	2.5	2.5	2.15	2.75	2.6	1.55	1.35	2.7
1	1.9	1.8	2.0	3.8	8.5	2.4	2.05	2.4	2.3	1.55	1.3	2.65
2	1.9	1.8	1.95	3.6	4.9	2.3	1.95	4.55	2.2	1.55	1.3	2.4
3	1.95	1.8	1.85	3.3	3.3	2.3	1.85	4.25	2.1	1.5	1.3	2.15
4	1.95	1.8	1.85	2.9	2.8	2.25	1.75	3.8	2.0	1.5	1.3	1.8
5	1.9	1.8	7.5	2.8	2.6	2.25	1.7	3.5	1.95	1.5	1.3	1.6
6	1.9	1.8	6.5	2.75	2.5	2.35	1.65	3.2	1.95	1.5	1.3	1.5
7	1.9	1.8	4.5	2.7	2.45	2.4	1.55	3.3	1.9	1.5	1.3	1.45
8	1.9	1.8	3.9	2.6	2.4	2.4	1.55	5.8	1.9	1.45	1.3	1.4
9	1.9	.....	2.95	2.5	2.4	2.35	1.5	4.1	1.9	1.45	1.25	10.5
0	1.9	.....	2.9	2.45	2.35	2.3	1.5	3.15	1.95	1.45	1.25	5.8
1	1.95	.....	2.75	.....	2.3	.....	1.4	2.3	.....	1.4	.....	4.1

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.							1904.						
1	.....	0.9	0.9	0.5	0.4	0.7	17	0.7	1.4	0.7	0.4	0.5	0.8
2	.....	1.3	.8	.5	.4	.7	18	.7	1.3	6	.4	.5	.8
3	.....	1.0	.8	.5	.6	.8	19	.7	1.1	6	.4	.5	.7
4	.....	.9	1.8	.5	1.0	.8	20	.6	1.5	7	.4	.5	.7
5	.....	.9	1.5	.5	.9	1.9	21	.6	1.0	6	.4	.5	.7
6	.....	1.0	1.0	.5	.6	1.7	22	.6	.9	6	.4	.6	.7
7	.....	2.5	.8	.5	.6	1.1	23	.7	.8	6	.4	.6	.7
8	.....	2.5	.8	.5	.5	.9	24	.7	1.0	6	.4	.6	.6
9	.....	1.6	.8	.5	.5	.8	25	1.2	1.4	.6	.4	.6	1.0
0	.....	1.7	.7	.5	.5	.8	26	.8	1.2	.6	.5	.5	.9
1	.....	2.6	.8	.5	.5	.7	27	.7	1.7	.6	.5	.5	.9
2	.....	2.0	.7	.5	.5	.7	28	.7	1.5	.7	.5	.5	2.4
3	.....	2.9	.8	.4	.8	.7	29	.8	1.1	.6	.5	.5	1.5
4	.....	1.7	.8	.4	.7	.7	30	.7	.9	.5	.4	.6	1.3
5	0.7	1.5	.7	.4	.6	.7	31	.9	.8	.....	.4	.....	1.1
6	.7	1.4	.7	.4	.5	.7							

Daily gage height, in feet, of Tallulah River at Tallulah Falls—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	1.1	1.2	1.8	1.6	1.7	1.2	3.5	1.4	1.1	0.8	0.9	0.9
2	1.0	1.1	1.7	1.6	1.6	1.2	1.9	1.4	1.1	.9	.9	1.0
3	1.0	1.1	1.7	1.5	1.8	1.1	1.4	1.3	1.0	.9	.9	4.5
4	.9	1.2	1.7	1.4	2.1	1.1	1.8	1.3	.9	1.1	.9	2.9
5	.9	1.2	1.6	1.8	2.0	1.1	2.0	1.4	.9	.9	1.0	2.5
6	1.0	1.5	1.7	1.6	2.9	1.2	4.2	1.4	1.1	.9	.9	1.3
7	1.8	1.8	1.7	1.7	2.9	1.2	1.3	1.3	1.0	.8	.9	1.2
8	1.3	1.8	1.8	1.7	2.2	1.4	1.7	2.3	1.1	.8	.9	1.4
9	1.1	2.7	3.5	1.5	2.1	1.3	1.6	2.1	1.1	1.1	.9	4.7
10	1.0	2.5	2.8	1.5	1.8	1.3	1.7	2.2	1.1	1.2	.8	2.8
11	1.1	2.3	2.3	1.5	1.7	1.4	3.5	2.5	1.0	3.1	.8	2.1
12	6.5	2.1	2.0	1.6	1.6	1.3	4.6	2.6	1.0	1.5	.8	1.8
13	3.2	3.2	1.8	1.6	1.6	1.2	3.4	2.5	1.0	1.3	.8	1.6
14	2.3	2.3	2.8	1.7	1.6	1.2	4.4	2.6	1.0	1.1	.8	1.6
15	1.9	2.1	1.7	1.7	1.7	1.3	3.0	2.0	.9	1.1	.8	1.7
16	1.6	1.8	1.7	1.8	3.1	1.4	2.4	1.8	1.0	1.1	.8	1.6
17	1.5	1.7	1.7	1.7	2.3	1.3	2.3	1.7	1.1	1.0	.9	1.7
18	1.4	1.5	1.6	1.7	2.0	1.4	2.1	1.7	1.0	1.0	.9	1.5
19	1.5	1.4	1.5	1.5	1.8	1.6	2.0	1.5	1.0	1.0	.9	1.5
20	1.4	2.5	1.7	1.5	1.6	1.7	2.1	1.6	.9	1.0	1.0	2.3
21	1.4	3.3	2.5	1.5	1.6	1.6	1.8	1.5	.9	1.0	1.0	2.1
22	1.4	3.0	2.0	1.5	1.8	1.8	1.7	1.4	1.0	1.0	.9	2.0
23	1.2	2.7	1.9	1.5	2.3	1.5	1.7	1.5	1.0	.9	.8	2.4
24	1.3	2.4	1.7	1.6	2.5	1.3	1.6	1.4	.9	.9	.9	2.4
25	1.3	2.2	1.7	1.6	1.8	1.3	1.6	1.5	.9	.9	1.0	2.5
26	1.1	2.0	1.8	1.7	1.9	1.2	1.7	1.5	.9	1.4	1.0	2.4
27	1.1	2.0	1.7	1.8	1.4	1.2	1.6	1.4	.8	1.3	.8	2.2
28	1.0	1.9	1.7	1.7	1.3	1.2	1.6	1.4	.8	1.2	.8	2.1
29	.9	.....	1.7	1.6	1.4	1.3	1.6	1.2	.8	1.0	.8	1.9
30	1.1	.....	1.6	1.9	1.2	1.4	1.4	1.2	.9	.9	.9	1.7
31	1.0	.....	1.6	.....	1.1	.....	1.4	1.1	.....	.9	.....	1.8

Rating table for Tallulah River at Tallulah Falls, from August 29, 1900, to December 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	125	1.30	355	2.20	800	3.50	1,805
0.50	145	1.40	395	2.30	860	4.00	2,230
0.60	165	1.50	435	2.40	930	5.00	3,080
0.70	185	1.60	480	2.50	1,000	6.00	3,930
0.80	210	1.70	525	2.60	1,070	7.00	4,780
0.90	235	1.80	575	2.70	1,145	8.00	5,630
1.00	260	1.90	630	2.80	1,220	9.00	6,480
1.10	290	2.00	685	2.90	1,300	10.00	7,330
1.20	320	2.10	740	3.00	1,380	11.00	8,180

[a] Above gage height 3.0 feet the rating curve is a tangent, the difference being 85 per tenth.

Estimated monthly discharge of Tallulah River at Tallulah Falls.

[Drainage area, 191 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1900.[a]					
September	3,420	210	467	2.44	2.72
October (1-19)	209	260	264	1.38	.975
1901.[a]					
January (18-31)	658	630	638	3.34	1.74
February	1,340	575	670	3.51	3.66
March	5,200	435	1,007	5.27	6.08
April	3,500	740	1,442	7.55	8.42
May	6,060	525	1,070	5.60	6.46
June	1,000	525	782	4.09	4.56
July	830	395	603	3.16	3.64
August	4,650	338	1,680	8.85	10.20
September	2,145	630	1,379	7.22	8.06
October	602	395	491	2.57	2.96
November	395	338	369	1.93	2.15
December	7,760	338	1,029	5.39	6.21
1904.					
July 15-31	320	165	195	1.02	0.645
August	1,300	210	447	2.34	2.70
September	575	145	209	1.09	1.22
October	145	125	135	.707	.815
November	260	125	160	.838	.935
December	930	165	266	1.39	1.60
1905.					
January	4,360	235	526	2.75	3.17
February	1,635	290	744	3.90	4.06
March	1,805	435	649	3.40	3.92
April	630	395	490	2.57	2.87
May	1,465	290	650	3.40	3.92
June	575	290	369	1.93	2.15
July	2,740	355	900	4.71	5.43
August	1,070	290	537	2.81	3.24
September	290	210	254	1.33	1.48
October	1,465	210	312	1.63	1.88
November	260	210	230	1.20	1.34
December	2,825	235	793	4.15	4.78
The year	4,360	210	538	2.82	38.24

[a] These are revised estimates based on the 1904 rating curve, which more nearly represents the true flow for low stages than the curve previously used.

TUGALOO RIVER NEAR MADISON, S. C.

This station was originally established July 19, 1898, at Cooks Ferry and was discontinued December 31, 1901, when the ferry was moved. It was reestablished July 7, 1903, by M. R. Hall, at Holcombs Ferry, 1 mile west of Madison, S. C., and 900 feet below the Southern Railway bridge. This station is about 1½ miles above the point where the old station was located.

The bed of the river is sandy and the current is moderately swift. The channel is about 160 feet wide and is fairly uniform in width and general appearance for some distance, being straight for 1,000 feet or more both above and below the station. The banks are both moderately high, but will overflow for about 200 feet on the right bank and 250 feet on the left. Both are open and cultivated except for a few trees along the edge of the river. These conditions make it possible to obtain fairly good float measurements at the time of floods.

Discharge measurements are made from the ferryboat, or a small boat which is held in place by a cable stretched across the river. The initial point for soundings is the land side of the windlass used for stretching the cable; it is located on the right bank. Distances are measured along the hand line which is used to pull the boat across the river.

The gage consists of a vertical timber in three sections. The first section reads from 1 to 16 feet and is attached to a sycamore tree on the left bank, about 30 feet above the ferry landing; the second section reads from 16 to 22 feet and is attached to a sycamore tree on the left bank, about 18 feet above the ferry landing; the third section reads from 21 to 31 feet and is fastened to a locust tree on the left bank at the forks of the road, about 175 feet from the ferry landing. The gage is read once each day by T. A. Spencer. The bench mark is a U. S. Geological Survey standard bronze tablet marked "666 Atlanta" on the right-bank pier of the Southern Railway bridge; elevation, 35.30 feet above the datum of the gage. It is 665.47 feet above sea level.

Discharge measurements of Tugaloo River near Madison, S. C.

Date.	Gage height.	Discharge.
1898.	*Feet.*	*Sec.-ft.*
May 25	1.50	902
June 9	.90	563
July 19	2.05	1,100
October 28	4.00	2,439
1899.		
April 21	4.50	2,604
May 22	3.20	1,687
June 20	2.10	1,325
September 12	1.00	734
October 4	.70	512
1900.		
February 21	4.25	2,243
August 30	1.71	872
December 25	3.60	1,717
December 27	2.80	1,414
1901.		
February 14	3.40	1,669
May 24	5.65	3,120
1903.		
June 24	4.00	1,927
July 7	3.69	1,677
July 9	3.40	1,535
July 31	2.84	1,091
August 28	2.18	798
September 24	1.94	715
October 9	2.23	927
1904.		
January 13	1.81	680
March 11	3.86	1,679
June 10	2.30	809
July 23	1.80	622
August 25	2.96	1,070
September 6	2.52	896
October 27	1.41	406
1905.		
March 7	3.38	1,317
March 20	3.25	1,243
March 21	3.75	1,552
March 21	4.00	1,795
May 1	3.31	1,264
June 29	2.56	874
September 8	2.78	970
October 14	2.66	880
November 17	2.13	641

Daily gage height, in feet, of Tugaloo River near Madison, S. C.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.							1898.						
1	.....	2.3	6.4	3.0	3.6	5.0	17	.....	4.1	3.7	4.3	3.6	2.7
2	.....	2.1	20.0	2.8	3.5	3.4	18	.....	6.4	3.6	9.35	3.6	2.7
3	.....	6.2	17.0	3.1	3	3.4	19	2.1	5.7	3.4	6.2	4.7	2.7
4	.....	9.75	13.0	18.0	3.3	3.5	20	1.9	5.7	3.3	5.0	4.0	4.5
5	.....	9.2	8.2	22.0	3	4.3	21	1.8	4.3	3.2	5.5	3.6	3.5
6	.....	6.7	7.3	14.0	4	3.6	22	1.7	3.8	3.4	6.3	3.4	3.2
7	.....	5.4	6.3	8.7	3.4	3.5	23	4.1	3.4	8.1	5.2	6.3	7.8
8	.....	6.1	5.4	7.8	3.3	3.4	24	4.4	3.4	4.3	4.7	4.7	4.7
9	.....	4.7	4.9	6.8	3.2	3.3	25	4.5	3.8	3.7	4.5	4.1	4.0
10	.....	4.8	4.9	6.2	3.3	3.2	26	4.0	3.9	3.4	4.3	3.9	3.7
11	.....	8.9	4.8	5.8	4.1	3.6	27	2.9	3.6	3.3	4.2	3.6	3.5
12	.....	7.95	4.5	5.5	3.4	3.0	28	4.1	3.1	3.2	4.1	3.4	3.4
13	.....	6.7	4.2	5.1	3.3	2.9	29	3.0	2.9	3.2	3.9	3.5	3.3
14	.....	7.9	4.1	4.8	4.0	2.9	30	2.8	3.4	3.1	3.9	3.8	3.2
15	.....	4.8	3.9	4.6	3.5	2.8	31	2.3	3.2	.....	3.7	.....	3.3
16	.....	4.5	3.8	4.4	3.4	2.8							

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
1	4.1	3.9	6.6	6.4	4.3	2.5	1.7	1.4	3.1	0.7	0.9	1.0
2	3.4	3.4	5.9	5.9	4.2	2.4	1.6	1.4	2.7	.7	.8	1.1
3	3.3	3.5	5.8	5.7	4.1	2.4	1.6	1.3	3.3	.7	.8	1.1
4	3.2	7.6	5.4	5.9	4.0	2.3	1.5	1.2	1.9	.7	.8	1.0
5	3.2	6.8	6.9	6.0	4.3	2.5	1.5	1.1	1.7	.8	.8	.9
6	6.45	11.85	6.0	5.6	4.1	3.3	1.6	1.1	1.4	.9	.7	.9
7	5.8	12.7	5.5	7.8	4.8	2.2	1.9	1.1	1.3	.8	.7	.9
8	4.6	8.8	5.2	8.7	4.0	2.2	1.6	1.0	1.2	3.3	.7	.8
9	4.2	6.8	5.1	6.8	3.8	2.1	1.6	1.0	1.2	2.5	.7	.8
10	3.9	5.8	4.9	6.2	3.7	2.0	1.6	1.4	1.1	1.5	.7	.8
11	4.2	5.5	4.8	5.8	3.7	2.2	1.5	1.3	1.1	1.0	.7	.9
12	4.1	5.3	4.7	5.5	3.6	3.9	1.4	1.0	1.0	.9	.7	12.3
13	3.9	8.4	4.2	5.3	3.6	5.3	1.3	.9	.9	.9	.7	8.45
14	4.0	4.4	8.05	5.2	3.4	3.5	1.3	1.0	.9	.8	.7	3.1
15	4.5	4.5	16.15	5.0	3.3	2.8	1.3	1.0	.8	.8	.7	2.5
16	4.0	5.6	13.8	5.1	3.2	2.4	1.2	1.0	.8	.8	.7	2.0
17	3.9	5.6	8.4	4.9	3.2	2.5	1.2	1.2	.8	.8	.7	1.8
18	3.7	5.0	6.9	4.8	3.1	2.4	1.2	1.0	.8	.9	.7	1.6
19	3.4	4.8	16.15	4.8	3.2	2.2	1.1	.9	.8	1.0	.7	1.6
20	3.4	4.6	11.6	4.6	3.0	2.1	1.2	.8	.9	1.0	.7	1.9
21	3.3	4.5	8.4	4.5	2.9	2.0	1.2	.8	.9	.9	.7	1.6
22	3.2	4.5	7.6	4.4	3.1	2.9	1.4	.8	.8	.9	.8	1.4
23	3.1	4.4	8.4	4.3	3.0	2.9	1.3	.9	.8	.9	.9	1.3
24	3.2	4.3	7.3	4.2	2.8	2.8	1.7	.8	.8	.8	1.1	5.0
25	3.4	4.1	6.8	6.8	2.7	2.0	1.4	.9	.8	.8	.9	3.0
26	3.2	6.5	6.4	6.0	2.7	1.8	4.1	.8	.9	.8	1.6	2.4
27	3.2	9.8	6.2	5.2	2.6	2.1	4.2	1.2	.9	.8	2.6	2.0
28	3.1	8.1	6.1	4.8	2.6	2.1	2.4	1.0	.8	.8	1.7	1.9
29	3.0	.....	6.8	4.6	2.6	2.0	2.9	.9	.8	.9	1.3	1.8
30	2.9	.....	6.0	4.4	2.5	1.8	1.9	1.4	.7	.9	1.1	1.6
31	3.1	.....	6.9	.....	2.5	.....	1.6	6.5	.....	.8	.....	1.4

Daily gage height, in feet, of Tugaloo River near Madison, S. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1	1.4	1.6	9.4	3.5	4.2	2.3	5.1	3.1	2.5	1.7	2.1	2.5
2	1.3	1.6	5.5	3.4	4.1	2.6	5.6	2.8	2.8	1.6	2.1	2.4
3	1.3	1.8	3.9	3.4	4.3	2.8	5.1	2.7	2.1	1.7	2.2	2.3
4	1.3	1.7	3.9	3.6	4.0	2.7	4.6	2.5	1.9	1.7	2.9	5.6
5	1.2	3.5	3.7	3.7	3.8	2.9	4.2	2.5	1.8	1.9	2.3	4.8
6	1.2	2.3	3.5	3.4	3.7	2.9	3.9	2.4	1.7	3.2	2.1	3.4
7	1.2	2.1	3.8	3.3	3.6	5.5	3.8	2.3	1.6	1.8	2.0	3.1
8	1.2	2.2	4.3	3.2	3.4	6.7	3.6	2.3	1.6	1.8	2.0	3.0
9	1.2	3.0	6.6	3.1	3.4	4.5	3.8	2.2	1.5	1.5	1.9	2.9
10	1.4	3.5	5.1	3.1	3.3	3.6	3.6	2.1	1.5	1.8	1.9	2.6
11	1.6	4.6	4.5	3.3	3.2	3.3	3.7	2.1	1.5	1.7	1.8	2.5
12	5.5	7.0	4.2	4.1	3.1	3.0	3.6	2.1	1.4	1.6	1.8	2.4
13	3.3	19.95	3.9	3.8	3.1	3.3	3.9	2.2	1.4	2.6	1.8	2.3
14	2.5	9.0	3.7	3.4	3.0	3.3	3.9	2.0	1.6	1.8	1.7	2.3
15	2.1	6.2	3.6	3.2	2.9	3.1	3.7	2.3	8.1	1.6	1.7	2.2
16	2.0	5.2	5.1	3.0	2.9	3.0	3.6	2.1	7.3	1.6	1.7	2.2
17	1.9	4.5	4.0	5.9	2.8	6.9	3.2	2.3	4.0	1.5	1.7	2.1
18	1.8	4.0	3.6	5.1	2.8	5.3	3.1	2.1	2.9	1.5	1.8	2.1
19	4.5	3.8	3.7	7.6	3.3	4.5	3.0	2.0	2.6	1.4	1.9	2.0
20	6.9	3.5	6.2	7.5	2.8	3.9	2.9	1.9	2.3	1.4	2.0	2.3
21	3.4	3.5	5.0	13.4	2.7	3.5	2.8	1.8	2.2	1.4	2.0	4.2
22	3.1	5.0	4.4	8.3	2.6	4.2	2.8	1.8	2.1	1.6	2.0	3.3
23	2.9	4.0	4.2	6.3	2.5	5.8	3.1	2.1	2.0	7.4	1.9	3.0
24	2.4	3.8	4.1	6.2	3.3	13.0	2.9	2.3	2.0	6.8	1.9	4.2
25	2.4	4.0	4.2	5.3	2.9	9.4	2.7	2.1	2.9	4.9	2.2	3.6
26	2.2	3.5	5.8	4.9	2.9	11.4	3.6	2.2	1.8	3.9	9.4	3.1
27	2.1	3.3	4.8	4.6	2.7	6.5	3.2	1.9	2.1	2.9	5.3	2.8
28	1.9	3.1	4.3	4.9	2.5	6.9	3.8	1.8	1.9	2.6	4.1	2.7
29	1.9	.....	4.1	4.7	2.5	6.4	3.1	1.7	1.8	2.5	3.0	2.6
30	1.8	.....	3.9	4.4	2.4	5.7	4.2	1.7	1.7	2.3	3.4	2.6
31	1.8	.....	3.7	.....	2.3	.....	3.3	2.8	.....	2.2	.....	4.0
1901.												
1	3.3	2.9	2.4	4.4	4.7	4.6	4.1	2.4	7.3	3.7	2.5	1.9
2	3.1	2.8	2.6	6.6	4.6	4.1	3.8	2.4	6.7	3.9	2.5	1.9
3	2.8	3.0	2.5	10.3	4.5	3.0	3.4	2.3	6.1	4.0	2.5	3.1
4	2.7	6.9	2.5	6.7	4.4	3.9	3.3	2.3	5.6	3.6	2.4	2.7
5	2.6	4.3	2.5	5.8	4.3	3.8	3.2	2.1	5.4	3.5	2.5	2.6
6	2.5	3.9	2.4	5.5	4.4	3.7	3.4	4.1	5.2	3.4	2.4	2.4
7	2.5	3.5	2.3	4.0	4.3	4.1	4.2	9.8	5.1	3.3	2.3	2.2
8	2.4	3.4	2.3	4.7	4.0	5.8	3.4	4.5	4.9	3.2	2.3	2.0
9	2.4	4.8	2.3	4.4	4.0	3.5	3.2	3.6	4.8	3.2	2.3	4.1
10	2.4	4.4	3.3	4.4	4.9	3.4	3.0	3.2	4.7	3.2	2.3	3.1
11	10.35	3.9	4.0	4.3	4.9	3.4	2.9	3.6	5.4	3.2	2.2	3.0
12	12.4	3.8	3.3	4.2	3.8	3.1	2.8	3.9	4.5	3.1	2.2	2.9
13	6.7	3.6	3.0	4.1	3.7	3.4	2.7	4.0	4.9	3.6	2.4	2.6
14	5.5	3.5	2.9	6.7	3.6	5.5	2.8	12.1	3.9	3.2	2.3	3.2
15	4.6	3.3	2.6	5.6	3.6	9.1	2.7	10.5	4.1	3.1	2.1	9.9
16	4.2	3.1	2.6	4.7	3.5	8.0	4.1	11.3	9.7	3.1	2.1	6.9
17	4.2	3.1	2.5	4.3	3.0	5.6	3.3	12.3	8.6	3.0	2.0	5.1
18	3.9	3.0	2.5	4.2	3.0	6.6	2.7	11.5	7.9	3.0	2.0	4.3
19	3.5	3.0	2.5	7.3	3.8	4.2	4.3	8.3	6.5	3.9	2.1	4.1
20	3.3	2.9	2.4	22.0	5.2	4.4	4.1	7.5	4.9	2.9	2.1	3.9
21	3.3	2.8	6.1	9.6	9.9	4.3	3.1	7.3	4.6	2.8	2.0	3.7
22	3.2	2.7	3.7	7.4	17.1	4.1	3.4	10.95	4.3	2.8	2.0	3.2
23	3.1	2.6	3.2	6.7	8.6	3.9	2.8	18.5	4.2	2.8	2.0	3.1
24	3.2	2.7	3.6	6.1	5.9	4.0	2.6	10.1	4.1	2.7	2.5	3.4
25	3.3	2.6	7.9	5.7	5.7	3.9	2.5	7.6	4.0	2.7	2.2	3.6
26	3.3	2.5	19.6	5.6	5.2	5.2	2.5	7.8	3.9	2.7	2.1	3.7
27	3.0	2.4	10.1	5.2	4.8	4.9	3.1	6.9	3.7	2.6	2.0	4.0
28	3.1	2.4	6.7	5.2	4.6	4.9	2.5	9.7	3.8	2.6	1.9	4.0
29	3.9	.....	5.7	4.9	4.4	4.6	2.4	11.9	4.2	2.6	1.9	20.0
30	3.8	.....	4.5	4.8	4.2	4.2	2.5	9.0	3.9	2.5	1.9	10.0
31	2.8	.....	4.4	.....	4.3	.....	2.5	8.6	.....	2.5	.....	7.1

Daily gage height, in feet, of Tugaloo River near Madison, S. C.—Continued.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.							1903.						
1		2.8	2.0	1.7	1.8	1.6	17	3.3	4.9	3.9	1.7	1.8	1.7
2		5.4	1.9	1.7	1.9	1.6	18	3.2	3.8	3.5	2.4	2.8	1.7
3		4.6	1.9	1.9	2.8	1.6	19	3.1	2.9	2.3	2.0	2.2	1.5
4		4.2	1.9	1.8	2.2	1.6	20	3.1	2.7	2.1	1.8	1.9	1.7
5		3.4	1.9	1.7	3.0	1.6	21	3.0	3.0	2.0	1.8	1.8	2.5
6		2.9	1.9	1.7	2.5	1.7	22	2.9	2.6	2.0	1.7	1.8	2.0
7	3.7	2.8	1.8	1.8	2.1	1.6	23	2.9	2.5	1.9	1.7	1.8	1.9
8	3.7	2.7	1.8	2.4	1.9	1.6	24	2.8	2.4	1.9	1.7	1.8	1.8
9	3.4	2.5	1.8	2.4	1.9	1.6	25	2.7	2.3	1.9	1.6	1.7	1.9
10	3.6	2.4	1.9	1.9	1.8	1.6	26	2.7	2.3	1.8	1.6	1.7	2.0
11	3.9	3.0	1.8	1.8	1.8	6	27	2.7	2.2	1.9	1.6	1.7	1.9
12	4.4	2.8	1.7	1.8	1.8	6	28	2.6	2.1	1.9	1.6	1.6	1.8
13	4.5	2.7	1.7	1.7	1.9	1.8	29	3.1	2.1	1.8	1.6	1.6	1.8
14	4.1	2.6	1.7	1.7	1.9	2.0	30	2.7	2.1	1.7	1.6	1.6	1.8
15	3.6	2.7	4.1	1.6	1.8	8	31	2.9	2.0	.....	1.6	.....	1.8
16	3.2	4.3	5.6	1.6	1.9	8							

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
1	1.7	2.0	2.7	3.35	2.7	3.3	2.4	3.7	2.35	1.6	1.4	1.5
2	1.7	1.9	2.8	3.2	2.7	3.4	2.0	3.95	2.2	1.55	1.4	1.6
3	1.8	1.9	2.8	3.1	2.85	2.8	2.0	2.5	2.4	1.6	1.5	1.6
4	1.7	1.9	2.5	2.95	3.1	2.6	1.9	2.4	3.2	1.55	2.2	1.7
5	1.6	1.9	2.5	2.9	2.9	2.4	1.8	2.4	3.2	1.5	2.2	2.0
6	1.6	1.8	2.3	2.85	2.8	2.35	1.8	2.45	2.65	1.5	2.0	4.9
7	1.9	2.0	13.2	4.1	2.7	2.3	1.8	7.0	2.3	1.5	1.6	2.6
8	1.7	4.8	6.9	3.9	4.95	3.3	1.8	6.9	2.2	1.5	1.5	2.1
9	1.6	3.0	5.0	6.1	6.5	2.5	2.1	4.1	2.2	1.5	1.5	1.9
10	1.6	2.5	4.2	4.5	4.5	2.3	2.3	5.5	2.2	1.55	1.5	1.8
11	1.7	2.6	3.9	4.0	3.6	2.3	2.0	6.6	2.05	1.5	1.5	1.8
12	1.7	2.9	3.6	3.7	3.3	2.3	1.9	5.4	2.1	1.45	1.5	1.8
13	1.8	2.3	3.4	3.5	3.1	2.2	2.1	3.8	2.05	1.45	1.8	1.8
14	1.7	2.1	3.5	3.4	3.05	2.1	1.8	3.3	2.0	1.4	2.0	1.7
15	1.7	2.1	3.6	3.3	3.0	2.1	1.75	2.8	1.9	1.4	1.8	1.7
16	1.6	2.1	3.3	3.2	2.9	2.1	1.7	3.0	1.85	1.4	1.6	1.65
17	1.9	2.1	3.1	3.1	2.8	2.1	1.8	2.5	1.9	1.4	1.5	1.7
18	2.0	2.0	3.05	3.1	2.75	2.1	1.8	2.3	1.8	1.4	1.5	1.75
19	1.8	2.2	2.95	3.0	2.7	2.1	1.7	2.2	1.75	1.35	1.5	1.7
20	1.8	4.4	2.85	2.9	2.6	2.5	1.6	3.8	1.75	1.35	1.5	1.65
21	1.7	3.2	2.8	2.95	2.55	2.5	1.55	2.5	1.75	1.4	1.55	1.6
22	5.1	9.5	5.3	2.9	2.5	2.2	2.2	2.2	1.9	1.35	1.6	1.65
23	6.5	5.4	5.3	2.8	2.5	2.1	1.85	2.05	1.8	1.35	1.8	1.6
24	3.1	4.2	5.8	2.8	2.45	2.0	1.75	2.2	1.7	1.35	1.7	1.6
25	2.8	3.5	4.9	2.8	2.45	1.95	1.9	2.2	1.7	1.4	1.55	1.9
26	2.4	3.2	4.7	2.9	2.4	1.95	2.0	2.85	1.7	1.4	1.5	2.0
27	2.3	3.0	4.3	3.3	2.4	1.9	1.9	4.5	1.7	1.4	1.5	1.95
28	2.2	3.0	4.0	2.9	2.3	1.9	1.7	3.6	1.65	1.4	1.5	7.0
29	2.2	2.8	3.7	2.85	2.25	2.7	2.0	2.8	1.7	1.45	1.5	3.5
30	2.1	.....	3.5	2.8	2.4	3.6	1.9	2.5	1.6	1.4	1.5	2.7
31	2.0	.....	3.4	.....	5.2	.....	3.95	2.3	.....	1.4	.....	2.3
1905.												
1	2.1	2.4	3.8	2.9	3.4	3.6	21.5	3.4	3.0	2.35	2.35	2.2
2	2.1	2.4	3.6	2.9	3.1	3.5	7.1	3.3	3.8	2.35	2.3	2.1
3	2.1	2.35	3.5	2.9	3.5	3.4	4.9	3.2	3.7	2.3	2.3	12.3
4	2.0	2.25	3.4	2.9	4.5	3.3	4.1	3.2	3.2	3.2	2.3	5.2
5	1.8	2.2	3.3	3.1	4.1	3.2	4.8	3.3	3.1	2.6	2.3	3.7
6	1.9	3.2	3.2	3.3	5.8	3.1	4.7	3.5	2.9	2.4	2.3	3.1
7	4.4	4.0	3.4	3.1	6.2	3.0	4.8	3.3	2.8	2.35	2.35	2.86
8	2.8	3.4	3.4	2.9	5.0	3.0	4.1	4.5	2.8	2.3	2.3	2.8
9	2.4	7.3	3.3	2.9	4.6	2.9	4.0	4.6	2.85	2.3	2.3	12.6
10	2.4	6.6	4.6	3.1	4.0	2.9	4.0	6.2	2.75	2.4	2.3	7.0
11	2.3	4.9	5.1	2.9	3.8	2.8	7.7	6.7	2.7	7.4	2.25	5.0
12	11.8	4.5	4.3	2.95	3.6	2.8	14.0	6.4	2.75	4.0	2.25	4.2
13	8.7	7.9	4.0	3.5	3.5	2.8	10.3	6.8	2.9	3.5	2.25	3.8
14	5.3	5.8	4.0	3.2	3.3	2.7	14.5	6.0	2.7	2.6	2.2	3.5
15	4.0	4.8	3.7	3.0	3.2	2.9	8.0	5.3	2.6	2.6	2.2	3.9

Daily gage height, in feet, of Tugaloo River near Madison, S. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
16	3.6	4.0	3.6	3.2	5.9	3.4	6.7	4.7	2.6	2.65	2.15	3.9
17	3.3	3.9	3.4	3.0	4.6	3.6	6.0	4.3	2.6	2.5	2.15	3.6
18	3.0	3.5	3.4	2.9	3.9	3.1	5.3	4.2	2.55	2.4	2.1	3.4
19	2.9	3.3	3.3	2.8	3.6	2.9	5.3	4.1	2.6	2.45	2.1	3.2
20	2.9	7.1	3.3	2.8	3.4	3.2	5.3	3.9	2.6	2.45	2.55	3.4
21	2.8	9.5	3.5	2.75	3.3	3.4	4.7	3.8	2.6	2.45	2.35	7.0
22	2.6	6.9	4.1	2.8	3.5	3.8	4.5	3.7	2.5	2.3	2.2	5.2
23	2.5	5.9	3.7	2.7	6.2	3.3	4.2	3.5	2.45	2.35	2.15	4.4
24	2.5	5.1	3.5	2.7	6.6	3.0	4.1	3.9	2.4	2.3	2.1	4.6
25	2.4	4.7	3.4	2.65	4.5	2.8	4.0	3.8	2.35	2.35	2.3	4.1
26	2.0	4.4	3.3	2.7	4.3	2.7	3.9	4.0	2.35	2.9	2.4	3.8
27	2.1	4.1	3.2	3.5	4.9	2.6	3.8	3.4	2.3	2.7	2.25	3.6
28	2.4	4.0	3.1	3.3	5.4	2.65	3.7	3.3	2.3	2.5	2.15	3.5
29	2.3	.....	3.1	3.0	4.6	2.6	3.8	3.2	2.3	2.45	2.15	4.5
30	2.4	.....	3.0	4.0	4.1	15.0	3.6	3.1	2.3	2.4	2.2	3.9
31	2.4	.....	3.0	.....	3.9	.....	3.5	3.0	.....	2.4	.....	3.6

Rating tables for Tugaloo River near Madison, S. C.

JULY 19 TO DECEMBER 31, 1898.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	975	3.10	1,807	4.50	2,835	5.90	3,941
1.80	1,030	3.20	1,874	4.60	2,914	6.00	4,020
1.90	1,085	3.30	1,941	4.70	2,993	6.20	4,178
2.00	1,140	3.40	2,008	4.80	3,072	6.40	4,336
2.10	1,200	3.50	2,075	4.90	3,151	6.60	4,494
2.20	1,260	3.60	2,148	5.00	3,230	6.80	4,652
2.30	1,320	3.70	2,221	5.10	3,309	7.00	4,810
2.40	1,380	3.80	2,294	5.20	3,388	7.20	4,968
2.50	1,440	3.90	2,367	5.30	3,467	7.40	5,126
2.60	1,500	4.00	2,440	5.40	3,546	7.60	5,284
2.70	1,560	4.10	2,519	5.50	3,625	7.80	5,442
2.80	1,620	4.20	2,598	5.60	3,704	8.00	5,600
2.90	1,680	4.30	2,677	5.70	3,788		
3.00	1,740	4.40	2,756	5.80	3,862		

JANUARY 1 TO DECEMBER 31, 1899.[b]

0.70	512	3.00	,685	5.30	3,100	9.20	6,220
.80	563	3.10	,736	5.40	3,180	9.40	6,380
.90	614	3.20	,787	5.50	3,260	9.60	6,540
1.00	665	3.30	,838	5.60	3,340	9.80	6,700
1.10	716	3.40	,889	5.70	3,420	10.00	6,860
1.20	767	3.50	,940	5.80	3,500	10.50	7,260
1.30	818	3.60	1,991	5.90	3,580	11.00	7,660
1.40	869	3.70	2,042	6.00	3,660	11.50	8,060
1.50	920	3.80	2,093	6.20	3,820	12.00	8,460
1.60	971	3.90	,144	6.40	3,980	12.50	8,860
1.70	1,022	4.00	2,195	6.60	4,140	13.00	9,260
1.80	1,073	4.10	2,250	6.80	4,300	13.50	9,660
1.90	1,124	4.20	,310	7.00	4,460	14.00	10,060
2.00	1,175	4.30	2,370	7.20	4,620	14.50	10,460
2.10	1,226	4.40	2,434	7.40	4,780	15.00	10,860
2.20	1,277	4.50	,500	7.60	4,940	15.50	11,260
2.30	1,328	4.60	,570	7.80	5,100	16.00	11,660
2.40	1,379	4.70	,640	8.00	5,260	17.00	12,460
2.50	1,430	4.80	710	8.20	5,420	18.00	13,260
2.60	1,481	4.90	780	8.40	5,580	19.00	14,060
2.70	1,533	5.00	2,860	8.60	5,740	20.00	14,860
2.80	1,583	5.10	2,940	8.80	5,900		
2.90	1,634	5.20	3,020	9.00	6,060		

[a] Discharge estimated above gage height 8.00 feet.
[b] Above gage height 4.00 feet the rating curve is a tangent, the difference being 80 per tenth.

Rating tables for Tugaloo River near Madison, S. C.—Continued.

JANUARY 1, 1900, TO DECEMBER 31, 1901.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	705	2.20	1,090	3.20	1,580	4.20	2,220
1.30	740	2.30	1,135	3.30	1,635	4.30	2,300
1.40	775	2.40	1,180	3.40	1,690	4.40	2,380
1.50	810	2.50	1,225	3.50	1,745	4.50	2,460
1.60	845	2.60	1,275	3.60	1,800	4.60	2,540
1.70	880	2.70	1,325	3.70	1,860	4.70	2,620
1.80	920	2.80	1,375	3.80	1,920	4.80	2,700
1.90	960	2.90	1,425	3.90	1,990		
2.00	1,000	3.00	1,475	4.00	2,060		
2.10	1,045	3.10	1,525	4.10	2,140		

JULY 7 TO DECEMBER 31, 1903.

1.50	510	2.50	980	3.50	1,560	4.50	2,320
1.60	552	2.60	1,032	3.60	1,630	4.60	2,400
1.70	596	2.70	1,086	3.70	1,700	4.70	2,480
1.80	640	2.80	1,140	3.80	1,775	4.80	2,560
1.90	686	2.90	1,195	3.90	1,850	4.90	2,640
2.00	732	3.00	1,250	4.00	1,925	5.00	2,720
2.10	790	3.10	1,310	4.10	2,000	5.40	3,040
2.20	828	3.20	1,370	4.20	2,080	5.60	3,200
2.30	878	3.30	1,430	4.30	2,160		
2.40	928	3.40	1,495	4.40	2,240		

JANUARY 1 TO DECEMBER 31, 1904.

1.35	435	2.50	915	3.70	1,582	5.80	3,180
1.40	452	2.60	963	3.80	1,646	6.00	3,365
1.50	490	2.70	1,012	3.90	1,710	6.20	3,555
1.60	528	2.80	1,062	4.00	1,775	6.40	3,745
1.70	567	2.90	1,114	4.20	1,905	6.60	3,940
1.80	607	3.00	1,168	4.40	2,045	6.80	4,140
1.90	648	3.10	1,224	4.60	2,195	7.00	4,340
2.00	690	3.20	1,281	4.80	2,345	9.50	7,325
2.10	733	3.30	1,339	5.00	2,505	13.20	14,450
2.20	777	3.40	1,398	5.20	2,665		
2.30	822	3.50	1,458	5.40	2,830		
2.40	868	3.60	1,519	5.60	3,000		

JANUARY 1 TO DECEMBER 31, 1905.[b]

1.80	520	3.30	1,275	4.80	2,410	7.60	5,220
1.90	560	3.40	1,340	4.90	2,500	7.80	5,440
2.00	600	3.50	1,405	5.00	2,590	8.00	5,660
2.10	640	3.60	1,470	5.20	2,770	9.00	6,840
2.20	680	3.70	1,540	5.40	2,960	10.00	8,040
2.30	725	3.80	1,610	5.60	3,160	11.00	9,260
2.40	770	3.90	1,680	5.80	3,360	12.00	10,460
2.50	820	4.00	1,755	6.00	3,560	13.00	11,660
2.60	870	4.10	1,830	6.20	3,760	14.00	12,860
2.70	925	4.20	1,910	6.40	3,960	15.00	14,060
2.80	980	4.30	1,990	6.60	4,160	16.00	15,260
2.90	1,035	4.40	2,070	6.80	4,360	18.00	17,660
3.00	1,095	4.50	2,155	7.00	4,560	20.00	20,060
3.10	1,155	4.60	2,240	7.20	4,780	22.00	22,460
3.20	1,215	4.70	2,325	7.40	5,000		

[a] Above gage height 4.80 this table is the same as the 1899 table.
[b] Above gage height 8.00 feet the rating curve is a tangent, the difference being 120 per tenth.

Estimated monthly discharge of Tugaloo River near Madison, S. C.

[Drainage area, 593 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1898.					
July 19-31	2,835	975	1,824	3.08	1.49
August	6,982	1,200	3,354	5.66	6.52
September	13,658	1,807	3,771	6.36	7.10
October	13,816	1,620	4,238	7.15	8.24
November	4,257	1,874	2,267	3.82	4.26
December	5,442	1,560	2,159	3.64	4.20
1899.					
January	4,020	1,634	2,099	3.54	4.08
February	9,020	1,880	3,790	6.37	6.63
March	11,780	2,310	4,771	8.05	9.28
April	5,820	2,310	3,276	5.52	6.16
May	2,710	1,430	1,881	3.17	3.66
June	3,100	1,073	1,448	2.44	2.72
July	2,310	716	1,027	1.73	1.99
August	4,060	563	801	1.35	1.56
September	1,838	512	765	1.29	1.44
October	1,838	512	662	1.12	1.29
November	1,481	512	619	1.04	1.16
December	8,700	563	1,411	2.38	2.74
The year	11,780	512	1,879	3.17	42.71
1900.					
January	4,380	705	1,223	2.06	2.38
February	14,820	845	2,508	4.23	4.40
March	6,380	1,745	2,505	4.22	4.86
April	9,580	1,475	2,751	4.64	5.17
May	2,300	1,135	1,562	2.63	3.04
June	9,260	1,135	2,931	4.94	5.51
July	3,340	1,325	1,884	3.18	3.66
August	1,525	880	1,095	1.85	2.13
September	5,340	775	1,305	2.20	2.45
October	4,780	775	1,290	2.18	2.52
November	6,380	880	1,322	2.23	2.48
December	3,340	1,000	1,491	2.51	2.90
The year	14,820	705	1,822	3.07	41.51
1901.					
January	8,780	1,180	2,153	3.63	4.19
February	4,380	1,180	1,719	2.90	3.02
March	15,540	1,135	2,444	4.12	4.75
April	16,460	2,060	3,804	6.42	7.16
May	12,540	1,475	2,932	4.95	5.71
June	6,140	1,475	2,549	4.30	4.80
July	2,300	1,180	1,570	2.65	3.05
August	13,660	1,045	4,876	8.22	9.48
September	6,620	1,840	3,047	5.14	5.74
October	2,060	1,225	1,542	2.60	3.00
November	1,225	980	1,091	1.84	2.05
December	14,820	900	2,577	4.35	5.01
The year	16,460	900	2,525	4.26	57.97
1903.					
July 7-31	2,320	1,032	1,441	2.43	2.26
August	3,040	732	1,283	2.16	2.49
September	3,200	596	874	1.47	1.64
October	928	552	634	1.07	1.23
November	1,250	552	720	1.21	1.35
December	980	510	623	1.05	1.21
1904.					
January	3,840	528	820	1.40	1.61
February	7,325	607	1,304	2.20	2.37
March	14,450	822	2,100	3.54	4.08
April	3,460	1,012	1,369	2.31	2.58
May	3,840	800	1,259	2.12	2.44
June	1,519	648	880	1.48	1.65
July	1,742	509	682	1.15	1.33
August	4,340	712	1,543	2.60	3.00
September	1,281	528	717	1.21	1.35
October	528	435	469	.791	.912
November	777	452	580	.909	1.01
December	4,340	490	830	1.40	1.61
The year	14,450	435	1,043	1.76	23.94

Estimated monthly discharge of Tugaloo River near Madison, S. C.—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
January	10,220	520	1,442	2.43	2.80
February	7,460	680	2,494	4.21	4.38
March	2,680	1,095	1,466	2.47	2.85
April	1,755	898	1,107	1.87	2.09
May	4,160	1,155	2,087	3.52	4.06
June	14,060	870	1,572	2.65	2.96
July	21,860	1,405	4,025	6.79	7.83
August	4,360	1,095	1,986	3.35	3.86
September	1,610	725	942	1.59	1.77
October	5,000	725	996	1.68	1.94
November	845	640	704	1.19	1.33
December	11,180	640	2,414	4.07	4.69
The year	21,860	520	1,770	2.98	40.56

SAVANNAH RIVER NEAR CALHOUN FALLS, S. C.

Systematic measurements were begun at this point August 4, 1896. The station is located at the Seaboard Air Line Railroad bridge, 3 miles west of Calhoun Falls, S. C., above the mouth of Beaver Dam Creek, at the head of Trotters Shoal, and about one-fourth mile below the mouth of Rocky River. The observer is Peter J. Pfeiffer, who reads the gage once daily. The station is also used by the United States Weather Bureau, which pays the gage reader.

The river is divided into two channels by a large island containing several hundred acres. Both channels are slightly curved for about 2,000 feet above the bridge and are straight for about 500 feet below. The west channel, which is the main river, is sluggish only at low water. It has a rough and rocky bed and in places the current is irregular.

The east channel is a good section, but has a low velocity. The right bank of the west channel and the left bank of the east channel are high and wooded and are not liable to overflow. The island between the channels is nearly covered at extreme high water. At low water the east channel is 150 feet wide and from 3 to 4 feet deep. The main channel is about 400 feet wide and from 2 to 8 feet deep.

Discharge measurements are made from the upstream side of the railroad bridge, to which the gage is attached. This bridge consists of one short span 175 feet in length across the east channel and three spans of 155 feet each across the west, or main, channel. These two sections are connected by 875 feet of a wooden trestle, from 35 to 45 feet high, which crosses the island between the two channels. The base of the rail is about 54 feet above low water. The initial point for soundings is the left-bank end of the iron bridge on the upstream side. A separate initial point has been used for each channel, the description being the same in both cases.

The chain gage is bolted to the downstream guard rail, 185 feet from the initial point for soundings. The length of the chain from the index to the end of weight is 57.10 feet.

Bench mark No. 1 is the top of the iron girder under the cross-ties of the downstream side of the bridge at a point 40 feet west of the second pier from the east end of the bridge; elevation, 54 feet above the gage datum. Bench mark No. 3 is a copper plug set in solid rock on the east bank of the east channel, 15 feet from the edge of the water and 110 feet upstream from the center of the railroad track; elevation, 14.38 feet above gage datum. The station was discontinued December 31, 1903.

Gage heights and monthly estimates of flow for 1901 and 1902, previously published for this station, are considered unreliable and hence are not republished in this paper.

Discharge measurements of Savannah River near Calhoun Falls, S. C.

Date.	Gage height.	Discharge.
1896.	*Feet.*	*Sec.-ft.*
August 4	2.40	2,668
September 22	1.77	1,531
October 31	2.10	2,054
1897.		
January 20	2.90	4,204
April 28	3.21	6,446
June 12	2.80	4,469
September 29	1.90	1,603
November 3	2.92	3,812
1898.		
April 16	2.75	4,081
1899.		
March 4	4.77	12,080
May 16	3.45	5,258
September 28	2.30	2,057
November 10	2.25	2,039
1900.		
March 1	5.47	13,800
1901.		
January 21	3.15	5,331
April 25	4.60	10,430
August 13	4.55	10,840
1902.		
July 19	2.50	2,517
October 1	3.45	6,844
1903.		
March 20	4.15	9,760
May 7	3.60	7,103
June 10	4.75	10,900
August 13	2.80	3,823
September 15	2.52	3,209
October 28	2.33	2,534
December 8	2.12	2,088

Daily gage height, in feet, of Savannah River near Calhoun Falls, S. C.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1896.						1896.					
1		2.0	2.0	2.2	5.6	17	2.1	2.0	1.95	3.0	3.4
2		1.9	1.95	2.15	5.0	18	2.05	1.95	1.9	2.9	3.1
3		1.85	1.9	2.05	4.95	19	2.05	1.9	1.85	2.65	3.0
4	2.4	1.8	1.95	3.0	5.15	20	2.0	1.85	1.8	2.4	2.85
5	2.3	1.95	1.9	5.65	5.0	21	1.9	1.8	1.8	2.25	2.8
6	2.15	3.85	1.85	7.15	4.05	22	1.85	1.7	1.75	2.35	2.75
7	2.1	3.0	1.9	4.75	3.5	23	1.8	2.5	1.75	2.3	2.65
8	2.0	2.4	1.75	3.0	3.75	24	1.75	2.4	2.15	2.3	2.6
9	2.05	2.4	1.7	2.6	3.05	25	1.75	2.35	2.05	2.3	2.55
10	2.1	2.25	1.7	2.45	3.2	26	2.0	2.25	2.0	2.25	2.5
11	2.05	2.2	2.0	2.3	2.85	27	2.45	2.0	1.95	2.25	2.45
12	2.0	2.3	2.25	2.2	2.6	28	2.0	1.9	1.9	2.2	2.4
13	1.95	2.15	2.5	5.6	2.45	29	1.95	1.95	1.85	2.3	2.4
14	2.8	2.1	2.4	4.1	2.55	30	1.9	2.0	1.95	2.95	2.4
15	3.1	2.05	2.15	3.6	3.85	31	1.95	.....	2.1	.....	2.35
16	2.3	2.0	2.0	3.25	3.2						

Daily gage height, in feet, of Savannah River near Calhoun Falls, S. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1897.												
1	2.5	2.8	3.0	5.4	3.8	2.2	2.8	2.5	2.2	1.8	2.55	2.8
2	2.4	5.2	2.95	6.9	5.65	2.15	2.65	2.4	2.4	1.8	3.4	2.7
3	2.4	4.0	2.8	5.2	4.3	3.05	2.55	2.35	2.3	1.85	3.05	2.85
4	2.4	3.6	2.8	4.75	3.95	4.4	2.4	2.25	2.25	1.85	2.7	3.0
5	2.35	3.25	2.75	11.65	3.85	4.1	2.3	2.1	2.05	1.8	2.55	2.9
6	2.35	6.0	2.65	13.35	3.8	3.1	3.05	2.65	2.0	1.75	2.45	2.75
7	2.3	8.55	6.8	8.15	3.7	2.95	2.5	2.95	1.95	1.75	2.35	2.7
8	2.25	7.2	4.65	4.95	3.65	3.05	2.4	2.9	1.95	1.7	2.25	2.6
9	2.25	5.05	4.2	4.05	3.4	3.25	2.65	2.7	1.9	1.65	2.2	2.55
10	2.25	4.1	4.0	4.0	3.25	3.05	2.45	2.6	1.85	1.75	2.2	2.55
11	2.2	3.85	4.4	4.15	3.15	2.95	2.5	2.4	1.8	2.25	2.15	2.5
12	2.2	5.15	5.5	4.1	3.05	2.8	2.55	2.3	1.8	2.65	2.1	2.4
13	2.3	4.4	7.75	4.0	3.0	3.0	3.25	2.25	1.85	2.4	2.1	2.35
14	3.05	4.1	7.25	3.95	3.05	2.85	2.65	2.2	1.8	2.25	2.05	2.95
15	2.75	4.0	6.0	3.95	3.1	2.8	2.55	2.15	1.8	2.2	2.0	2.8
16	2.6	4.05	5.2	3.85	3.15	3.0	2.45	2.2	1.75	2.15	2.0	2.7
17	2.55	3.95	4.15	3.8	3.1	3.05	2.5	2.25	1.75	2.1	2.05	2.65
18	3.35	3.8	3.85	3.75	3.05	2.95	3.9	2.2	1.7	2.15	2.0	2.55
19	3.1	3.65	3.5	3.65	3.0	2.85	3.3	2.3	1.7	2.4	2.0	2.5
20	2.9	3.7	4.0	3.5	2.95	2.8	3.1	2.25	1.75	3.05	1.95	2.45
21	5.4	3.5	5.35	3.4	2.9	2.7	4.05	2.2	1.75	2.6	1.95	2.5
22	3.95	3.35	4.4	3.35	2.9	2.65	3.45	2.7	1.85	2.4	1.9	2.65
23	3.6	4.05	4.1	3.3	2.85	2.55	3.0	2.6	2.75	2.35	1.9	2.6
24	3.2	3.8	4.0	3.25	2.75	2.55	2.75	2.4	2.25	2.3	1.85	2.55
25	3.1	4.0	3.9	3.25	2.7	2.45	2.65	2.3	2.05	2.25	1.85	2.5
26	3.0	3.9	3.65	3.3	2.6	2.5	2.95	2.25	2.0	2.3	2.0	2.9
27	2.95	3.45	3.05	3.25	2.55	2.4	3.5	2.2	2.0	2.25	3.25	2.4
28	2.95	3.2	3.4	3.2	2.4	2.3	3.0	2.15	1.95	2.2	3.05	2.4
29	2.9	.....	3.25	3.25	2.35	3.5	2.9	2.1	1.9	2.2	2.95	2.35
30	2.9	.....	3.25	3.4	2.25	2.95	2.7	2.0	1.85	2.15	2.85	2.35
31	2.75	.....	3.3	.....	2.2	.....	2.55	2.05	.....	2.1	.....	2.3
1898.												
1	2.3	3.25	2.3	4.6	2.65	1.8	1.75	3.2	.....	.....	.....	.....
2	2.3	3.1	2.35	3.4	2.75	1.8	1.7	3.0	.....	.....	.....	.....
3	2.25	3.0	2.45	3.25	2.8	1.8	1.65	3.6	.....	.....	.....	.....
4	2.25	2.9	2.8	3.0	2.8	1.75	1.6	3.0	.....	.....	.....	.....
5	2.2	2.85	3.0	4.45	2.75	1.95	1.9	2.75	.....	.....	.....	.....
6	2.4	2.8	2.8	4.0	2.7	2.05	2.45	2.5	.....	.....	.....	.....
7	2.35	2.75	2.65	3.8	2.6	2.0	2.75	5.05	.....	.....	.....	.....
8	2.3	2.65	2.6	3.55	2.55	1.95	3.95	4.4	.....	.....	.....	.....
9	2.25	2.6	2.5	3.2	2.5	1.85	3.05	[a] 3.25	.....	.....	.....	.....
10	2.25	2.6	2.45	3.0	2.5	1.8	2.6	.....	.....	.....	.....	.....
11	2.2	2.55	2.35	3.15	2.4	1.75	2.45	.....	.....	.....	.....	.....
12	2.2	2.6	2.25	3.05	2.25	1.75	2.3	.....	.....	.....	.....	.....
13	2.15	2.5	2.2	3.0	2.15	1.95	2.5	.....	.....	.....	.....	.....
14	2.15	2.5	2.25	3.0	2.0	1.9	4.9	.....	.....	.....	.....	.....
15	2.2	2.45	2.5	2.9	2.2	1.9	5.05	.....	.....	.....	.....	.....
16	2.4	2.4	2.4	2.7	2.1	1.95	3.95	.....	.....	.....	.....	.....
17	2.35	2.35	2.45	2.65	2.05	2.0	3.6	.....	.....	.....	.....	.....
18	2.35	2.3	2.35	2.55	2.0	2.05	3.4	.....	.....	.....	.....	.....
19	2.45	2.3	2.3	2.5	2.05	2.25	3.25	.....	.....	.....	.....	.....
20	2.85	2.3	2.3	2.65	2.0	2.35	3.0	.....	.....	.....	.....	.....
21	2.7	2.35	2.3	2.5	1.9	2.05	2.85	.....	.....	.....	.....	.....
22	2.65	2.3	2.25	2.45	2.0	2.0	2.5	.....	.....	.....	.....	.....
23	2.9	2.3	2.2	2.35	1.95	1.95	2.75	.....	.....	.....	.....	.....
24	2.85	2.25	2.25	2.75	1.95	1.9	4.0	.....	.....	.....	.....	.....
25	3.65	2.25	2.25	3.0	1.9	1.85	4.5	.....	.....	.....	.....	.....
26	5.5	2.25	2.2	2.85	1.85	1.9	4.05	.....	.....	.....	.....	.....
27	4.65	2.35	2.2	3.05	1.85	1.85	3.85	.....	.....	.....	.....	.....
28	4.05	2.4	2.25	2.9	1.8	1.8	4.0	.....	.....	.....	.....	.....
29	3.85	.....	2.3	2.8	1.8	1.8	3.75	.....	.....	.....	.....	.....
30	3.6	.....	3.9	2.7	1.85	1.8	3.9	.....	.....	.....	.....	.....
31	3.45	.....	6.75	.....	1.8	.....	3.65	.....	.....	.....	.....	.....

[a] Discontinued August 9, 1898, and reestablished March 4, 1899.

The chain gage is bolted to the downstream guard rail, 185 feet from the initial point for soundings. The length of the chain from the index to the end of weight is 57.10 feet.

Bench mark No. 1 is the top of the iron girder under the cross-ties of the downstream side of the bridge at a point 40 feet west of the second pier from the east end of the bridge; elevation, 54 feet above the gage datum. Bench mark No. 3 is a copper plug set in solid rock on the east bank of the east channel, 15 feet from the edge of the water and 110 feet upstream from the center of the railroad track; elevation, 14.38 feet above gage datum. The station was discontinued December 31, 1903.

Gage heights and monthly estimates of flow for 1901 and 1902, previously published for this station, are considered unreliable and hence are not republished in this paper.

Discharge measurements of Savannah River near Calhoun Falls, S. C.

Date.	Gage height.	Discharge.
1896.	*Feet.*	*Sec.-ft.*
August 4	2.40	2,668
September 22	1.77	1,531
October 31	2.10	2,054
1897.		
January 20	2.90	4,204
April 28	3.21	6,446
June 12	2.80	4,409
September 29	1.90	1,693
November 3	2.92	3,812
1898.		
April 16	2.75	4,081
1899.		
March 4	4.77	12,080
May 16	3.45	5,258
September 28	2.30	2,057
November 10	2.25	2,039
1900.		
March 1	5.47	13,800
1901.		
January 21	3.15	5,331
April 25	4.60	10,430
August 13	4.55	10,840
1902.		
July 19	2.50	2,517
October 1	3.45	6,844
1903.		
March 20	4.15	9,769
May 7	3.60	7,103
June 10	4.75	10,900
August 13	2.80	3,823
September 15	2.52	3,209
October 28	2.33	2,534
December 8	2.12	2,008

Daily gage height, in feet, of Savannah River near Calhoun Falls, S. C.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1896.						1896.					
1		2.0	2.0	2.2	5.6	17	2.1	2.0	1.95	3.0	3.4
2		1.9	1.95	2.15	5.0	18	2.05	1.95	1.9	2.9	3.1
3		1.85	1.9	2.05	4.65	19	2.05	1.9	1.85	2.65	3.0
4	2.4	1.8	1.95	3.0	5.15	20	2.0	1.85	1.8	2.4	2.85
5	2.3	1.95	1.9	5.65	5.0	21	1.9	1.8	1.8	2.25	2.8
6	2.75	3.85	1.85	7.15	4.05	22	1.85	1.7	1.75	2.35	2.75
7	2.1	3.0	1.9	4.75	3.5	23	1.8	2.5	1.75	2.3	2.65
8	2.0	2.4	1.75	3.0	3.75	24	1.75	2.4	2.15	2.3	2.6
9	2.05	2.4	1.7	2.6	3.05	25	1.75	2.35	2.05	2.3	2.55
10	2.1	2.25	1.7	2.45	3.2	26	2.0	2.25	2.0	2.25	2.5
11	2.05	2.2	2.0	2.3	2.85	27	2.45	2.0	1.95	2.25	2.45
12	2.0	2.3	2.25	2.2	2.6	28	2.0	1.9	1.9	2.2	2.4
13	1.95	2.15	2.5	5.6	2.45	29	1.95	1.95	1.85	2.3	2.4
14	2.8	2.1	2.4	4.1	2.55	30	1.9	2.0	1.95	2.05	2.4
15	3.1	2.05	2.15	3.6	3.85	31	1.95	.....	2.1	.....	2.35
16	2.3	2.0	2.0	3.25	3.2						

Daily gage height, in feet, of Savannah River near Calhoun Falls, S. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1897.												
1	2.5	2.8	3.0	5.4	3.8	2.2	2.8	2.5	2.2	1.8	2.55	2.8
2	2.4	5.2	2.95	6.9	5.65	2.15	2.65	2.4	2.4	1.8	3.4	2.7
3	2.4	4.0	2.8	5.2	4.3	3.05	2.55	2.35	2.3	1.85	3.05	2.85
4	2.4	3.6	2.8	4.75	3.95	4.4	2.4	2.25	2.25	1.85	2.7	3.0
5	2.35	3.25	2.75	11.65	3.85	4.1	2.3	2.1	2.05	1.8	2.55	2.9
6	2.35	6.0	2.65	13.35	3.8	3.1	3.05	2.65	2.0	1.75	2.45	2.75
7	2.3	8.55	6.8	8.15	3.7	2.95	2.5	2.95	1.95	1.75	2.35	2.7
8	2.25	7.2	4.65	4.95	3.65	3.05	2.4	2.9	1.95	1.7	2.25	2.6
9	2.25	5.05	4.2	4.05	3.4	3.25	2.65	2.7	1.9	1.65	2.2	2.55
10	2.25	4.1	4.0	4.0	3.25	3.05	2.45	2.6	1.85	1.75	2.2	2.55
11	2.2	3.85	4.4	4.15	3.15	2.95	2.5	2.4	1.8	2.25	2.15	2.5
12	2.2	5.15	5.5	4.1	3.05	2.8	2.55	2.3	1.8	2.65	2.1	2.4
13	2.3	4.4	7.75	4.0	3.0	3.0	3.25	2.25	1.85	2.4	2.1	2.35
14	3.05	4.1	7.25	3.95	3.05	2.85	2.65	2.2	1.8	2.25	2.05	2.95
15	2.75	4.0	6.0	3.95	3.1	2.8	2.55	2.15	1.8	2.2	2.0	2.8
16	2.6	4.05	5.2	3.85	3.15	3.0	2.45	2.2	1.75	2.15	2.0	2.7
17	2.55	3.95	4.15	3.8	3.1	3.05	2.5	2.25	1.75	2.1	2.05	2.65
18	3.35	3.8	3.85	3.75	3.05	2.95	3.9	2.2	1.7	2.15	2.0	2.55
19	3.1	3.65	3.5	3.65	3.0	2.85	3.3	2.3	1.7	2.4	2.0	2.5
20	2.9	3.7	4.0	3.5	2.95	2.8	3.1	2.25	1.75	3.05	1.95	2.45
21	5.4	3.5	5.35	3.4	2.9	2.7	4.05	2.2	1.75	2.6	1.95	2.5
22	3.95	3.35	4.4	3.35	2.9	2.65	3.45	2.7	1.85	2.4	1.9	2.65
23	3.6	4.05	4.1	3.3	2.85	2.55	3.0	2.6	2.75	2.35	1.9	2.6
24	3.2	3.8	4.0	3.25	2.75	2.55	2.75	2.4	2.25	2.3	1.85	2.55
25	3.1	4.0	3.9	3.25	2.7	2.45	2.65	2.3	2.05	2.25	1.85	2.5
26	3.0	3.9	3.65	3.3	2.6	2.5	2.95	2.25	2.0	2.3	2.0	2.9
27	2.95	3.45	3.05	3.25	2.55	2.4	3.5	2.2	2.0	2.25	3.25	2.4
28	2.95	3.2	3.4	3.2	2.4	2.3	3.0	2.15	1.95	2.2	3.05	2.4
29	2.9	.....	3.25	3.25	2.35	3.5	2.9	2.1	1.9	2.2	2.95	2.35
30	2.9	.....	3.25	3.4	2.25	2.95	2.7	2.0	1.85	2.15	2.85	2.35
31	2.75	.....	3.3	.....	2.2	.....	2.55	2.05	.....	2.1	.....	2.3
1898.												
1	2.3	3.25	2.3	4.6	2.65	1.8	1.75	3.2	.....	.....	.....	.....
2	2.3	3.1	2.35	3.4	2.75	1.8	1.7	3.0	.....	.....	.....	.....
3	2.25	3.0	2.45	3.25	2.8	1.8	1.65	3.6	.....	.....	.....	.....
4	2.25	2.9	2.8	3.0	2.8	1.75	1.6	3.0	.....	.....	.....	.....
5	2.2	2.85	3.0	4.45	2.75	1.95	1.9	2.75	.....	.....	.....	.....
6	2.4	2.8	2.8	4.0	2.7	2.05	2.45	2.5	.....	.....	.....	.....
7	2.35	2.75	2.65	3.8	2.6	2.0	2.75	5.05	.....	.....	.....	.....
8	2.3	2.65	2.6	3.55	2.55	1.95	3.95	4.4	.....	.....	.....	.....
9	2.25	2.6	2.5	3.2	2.5	1.85	3.05	[a] 3.25	.....	.....	.....	.....
10	2.25	2.6	2.45	3.0	2.5	1.8	2.6	.....	.....	.....	.....	.....
11	2.2	2.55	2.35	3.15	2.4	1.75	2.45	.....	.....	.....	.....	.....
12	2.2	2.6	2.25	3.05	2.25	1.75	2.3	.....	.....	.....	.....	.....
13	2.15	2.5	2.2	3.0	2.15	1.95	2.5	.....	.....	.....	.....	.....
14	2.15	2.5	2.25	3.0	2.0	1.9	4.9	.....	.....	.....	.....	.....
15	2.2	2.45	2.5	2.9	2.2	1.9	5.05	.....	.....	.....	.....	.....
16	2.4	2.4	2.4	2.7	2.1	1.95	3.95	.....	.....	.....	.....	.....
17	2.35	2.35	2.45	2.65	2.05	2.0	3.6	.....	.....	.....	.....	.....
18	2.35	2.3	2.35	2.55	2.0	2.05	3.4	.....	.....	.....	.....	.....
19	2.45	2.3	2.3	2.5	2.05	2.25	3.25	.....	.....	.....	.....	.....
20	2.85	2.3	2.3	2.65	2.0	2.35	3.0	.....	.....	.....	.....	.....
21	2.7	2.35	2.3	2.5	1.9	2.05	2.85	.....	.....	.....	.....	.....
22	2.65	2.3	2.25	2.45	2.0	2.0	2.5	.....	.....	.....	.....	.....
23	2.9	2.3	2.2	2.35	1.95	1.95	2.75	.....	.....	.....	.....	.....
24	2.85	2.25	2.25	2.75	1.95	1.9	4.0	.....	.....	.....	.....	.....
25	3.65	2.25	2.25	3.0	1.9	1.85	4.5	.....	.....	.....	.....	.....
26	5.5	2.25	2.2	2.85	1.85	1.9	4.05	.....	.....	.....	.....	.....
27	4.65	2.35	2.2	3.05	1.85	1.85	3.85	.....	.....	.....	.....	.....
28	4.05	2.4	2.25	2.9	1.8	1.8	4.0	.....	.....	.....	.....	.....
29	3.85	.....	2.3	2.8	1.8	1.8	3.75	.....	.....	.....	.....	.....
30	3.6	.....	3.9	2.7	1.85	1.8	3.9	.....	.....	.....	.....	.....
31	3.45	.....	6.75	.....	1.8	.....	3.65	.....	.....	.....	.....	.....

[a] Discontinued August 9, 1898, and reestablished March 4, 1899.

Daily gage height, in feet, of Savannah River near Calhoun Falls, S. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
1				6.6	4.0	3.3	3.2	3.3	3.0	2.2	2.6	2.7
2				5.0	3.9	3.2	3.0	3.1	2.9	2.1	2.5	2.8
3				4.85	3.8	3.2	2.9	3.0	2.9	2.1	2.5	2.9
4			4.75	4.9	3.8	3.2	2.7	2.9	2.8	2.2	2.4	2.7
5			4.95	4.75	3.7	3.1	2.7	2.8	2.7	2.4	2.4	2.6
6			4.65	4.7	3.9	3.0	2.6	2.7	2.9	3.0	2.4	2.6
7			4.4	4.75	3.9	2.9	2.7	2.6	2.9	2.8	2.5	2.6
8			4.35	4.65	3.8	3.0	2.7	2.6	3.0	3.9	2.4	2.5
9			4.25	5.6	3.8	3.3	3.0	3.0	3.0	3.5	2.3	2.5
10			4.2	5.1	3.7	3.2	2.9	2.9	2.9	3.2	2.2	2.4
11			4.05	4.95	3.7	3.4	2.8	2.8	3.2	3.0	2.2	2.5
12			3.9	4.8	3.7	3.5	2.8	2.8	3.0	2.7	2.1	4.9
13			4.0	4.7	3.6	5.0	2.7	2.7	3.0	2.5	2.1	5.0
14			4.0	4.5	3.6	3.9	2.6	2.7	2.9	2.4	2.0	3.8
15			5.25	4.3	3.5	3.7	2.5	2.6	2.9	2.3	2.1	3.5
16			13.6	4.0	3.4	3.6	2.4	2.6	2.8	2.4	2.1	3.3
17			9.0	3.9	3.4	3.6	2.4	2.6	2.7	2.4	2.1	3.1
18			6.9	3.7	3.4	3.5	2.3	2.6	2.6	2.3	2.0	3.0
19			7.0	3.7	3.5	3.3	2.4	2.5	2.6	2.3	2.0	3.0
20			9.0	3.5	3.5	3.2	2.3	2.5	2.9	2.4	2.0	2.9
21			7.05	3.4	3.4	3.1	2.2	2.6	2.9	2.3	2.1	2.9
22			5.0	3.2	3.5	3.0	2.3	2.8	2.8	2.3	2.1	2.8
23			5.0	3.0	3.7	3.0	2.3	3.0	2.6	2.3	2.3	2.7
24			4.9	2.9	3.55	2.9	2.3	2.9	2.5	2.2	2.3	3.9
25			5.0	4.0	3.5	2.9	2.4	2.7	2.4	2.2	2.4	3.8
26			5.1	4.6	3.4	3.0	2.7	2.7	2.6	2.2	4.0	3.5
27			4.95	5.1	3.25	3.9	2.7	2.8	2.4	2.1	3.4	3.5
28			4.85	5.0	3.2	4.0	5.0	3.0	2.3	2.1	3.2	3.6
29			6.95	4.7	3.2	3.6	3.5	2.9	2.3	2.2	2.9	3.7
30			5.1	4.1	3.1	3.3	3.6	3.5	2.2	2.3	2.8	3.6
31			7.0	.....	3.3	.....	3.4	3.2	.....	2.5	.....	2.9
1900.												
1	3.3	2.9	5.3	3.6	4.0	2.8	3.6	3.2	3.2	2.1	2.9	3.0
2	3.2	2.8	6.5	3.5	3.9	2.7	3.2	3.0	3.7	2.0	3.0	2.9
3	3.2	2.8	4.6	3.5	4.2	3.1	3.0	3.0	3.3	2.0	3.9	2.8
4	3.1	2.7	4.2	3.7	4.0	2.9	3.0	2.9	3.0	2.1	4.3	3.9
5	3.0	2.8	3.9	3.6	3.9	3.5	2.9	2.9	3.0	2.1	4.0	3.8
6	3.0	2.8	3.8	3.4	3.7	3.4	2.9	2.8	2.9	3.0	3.8	3.8
7	2.9	2.9	3.6	3.3	3.6	3.9	2.8	2.8	2.8	2.7	3.7	3.7
8	2.9	2.9	4.0	3.4	3.4	11.0	2.7	2.7	2.6	2.6	3.4	3.6
9	2.9	3.0	4.9	3.4	3.3	5.0	2.7	2.6	2.5	2.5	3.3	3.4
10	3.0	3.2	4.3	3.3	3.1	3.5	2.6	2.4	2.3	2.4	3.2	3.4
11	3.2	5.2	3.9	3.6	3.1	3.0	2.5	2.3	2.2	2.4	3.2	3.3
12	4.0	9.3	3.8	4.0	3.0	3.0	2.4	2.2	2.1	2.6	3.0	3.3
13	3.9	15.5	3.6	3.8	3.0	3.1	2.4	2.7	2.0	3.9	2.9	3.4
14	3.7	19.4	3.4	3.6	3.0	3.0	2.5	2.6	2.0	3.0	2.7	3.7
15	3.6	8.0	3.3	3.6	2.9	3.0	2.4	2.5	4.7	2.9	2.7	3.6
16	3.5	5.5	4.6	3.5	2.9	3.3	2.3	2.5	6.9	2.8	2.6	3.4
17	3.3	4.9	4.5	3.5	2.9	5.6	2.2	2.6	5.0	2.6	2.6	3.4
18	3.3	4.7	4.0	3.9	2.8	6.1	2.2	2.6	3.2	2.5	2.6	3.3
19	3.4	4.4	3.8	5.0	3.0	4.9	2.1	2.4	3.0	2.5	2.6	3.3
20	3.9	4.3	4.2	5.1	3.0	4.0	2.1	2.3	2.9	2.4	3.0	3.6
21	3.8	4.2	4.0	8.0	2.9	3.7	2.1	2.2	2.9	2.4	2.9	3.7
22	3.6	5.4	3.9	10.4	2.9	3.6	2.0	2.0	2.7	2.4	2.8	3.5
23	3.5	4.7	3.8	5.5	3.0	4.0	2.2	2.0	2.7	2.5	2.8	3.4
24	3.4	4.4	4.0	6.9	4.9	12.7	2.3	1.9	2.6	5.0	2.6	3.4
25	3.2	4.2	5.6	6.0	4.2	12.0	2.2	2.5	2.4	4.0	2.6	3.3
26	3.2	4.0	5.7	4.9	3.2	7.8	2.2	2.9	2.4	3.9	3.6	3.3
27	3.1	3.9	5.0	4.2	3.0	5.0	2.3	2.7	2.2	3.7	3.4	3.3
28	3.0	3.9	4.8	4.0	3.0	4.5	3.4	2.9	2.0	3.5	3.2	3.2
29	3.0	.....	4.2	4.2	2.9	3.9	3.2	2.3	2.0	3.3	3.1	3.2
30	3.0	.....	3.9	4.0	2.9	3.8	3.4	2.2	2.1	3.1	3.0	3.3
31	2.9	.....	3.7	.....	2.8	.....	3.1	2.1	.....	2.9	.....	3.3
1903.												
1	4.0	4.2	10.4	5.2	3.8	3.6	3.5	3.1	2.9	2.6	2.3	2.0
2	4.0	3.8	7.1	4.5	3.7	5.5	3.5	3.0	2.8	2.5	2.2	2.1
[illegible]	4.4	3.9	4.9	4.0	3.7	4.4	3.6	3.0	2.8	2.5	2.2	2.1
[illegible]	4.4	6.3	4.4	3.9	4.0	4.6	3.9	3.1	2.8	2.4	2.3	2.2
[illegible]	4.2	8.1	4.2	4.0	3.9	4.8	3.7	3.2	2.7	2.4	2.6	2.2

ly gage height, in feet, of Savannah River near Calhoun Falls, S. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
.....	4.1	6.4	4.1	3.9	3.7	7.0	3.8	3.4	2.7	2.4	2.5	2.3
.....	4.1	5.9	4.1	3.9	3.6	15.3	4.8	3.2	2.6	2.5	2.3	2.2
.....	4.0	12.7	4.0	4.0	3.5	8.0	4.0	3.1	2.6	2.5	2.2	2.2
.....	3.9	9.4	4.3	5.9	3.5	4.9	4.1	3.0	2.5	2.7	2.2	2.2
.....	3.9	5.3	4.2	4.5	3.5	4.0	3.9	3.0	3.0	2.6	2.2	2.3
.....	4.1	7.3	4.0	4.1	3.4	3.5	4.0	3.1	2.9	2.6	2.1	2.2
.....	4.4	11.2	6.3	4.0	3.4	4.0	4.1	3.2	2.8	2.5	2.1	2.2
.....	4.3	6.4	5.9	5.1	3.3	3.8	4.0	3.3	2.6	2.5	2.2	2.3
.....	4.1	4.6	4.6	12.9	3.3	3.7	4.2	3.4	2.7	2.4	2.2	2.2
.....	3.9	4.4	4.4	9.5	3.4	3.6	4.0	3.2	3.4	2.4	2.1	2.2
.....	3.8	5.3	4.4	5.0	3.5	3.5	3.8	3.1	4.2	2.5	2.1	2.1
.....	3.7	9.5	4.3	5.4	3.4	3.5	3.7	3.5	4.0	2.6	2.1	2.1
.....	3.6	8.4	4.2	5.0	3.3	3.4	3.5	5.5	3.5	3.0	2.2	2.2
.....	3.6	6.6	4.2	5.0	3.4	3.2	3.3	6.9	3.2	2.8	2.2	2.2
.....	3.6	5.4	4.3	4.9	3.4	3.0	3.2	4.5	3.0	2.6	2.7	2.3
.....	3.6	4.9	4.5	4.9	3.3	3.2	3.1	4.0	3.0	2.5	2.4	2.4
.....	3.7	4.5	5.9	4.8	3.3	3.1	3.0	3.7	2.9	2.4	2.3	2.3
.....	3.6	4.3	11.1	4.7	3.2	3.0	3.0	3.3	2.9	2.4	2.2	2.2
.....	3.5	4.1	14.5	4.5	3.2	3.1	3.1	3.1	2.8	2.3	2.2	2.2
.....	3.3	4.0	8.7	4.3	3.1	3.0	2.9	3.1	2.8	2.2	2.1	2.2
.....	3.2	3.7	6.9	4.0	3.0	3.0	2.9	3.0	2.8	2.2	2.1	2.1
.....	3.1	3.8	4.7	3.9	3.0	3.2	2.9	3.0	2.7	2.1	2.0	2.2
.....	3.3	7.0	4.4	3.9	3.1	3.5	2.8	2.9	2.7	2.2	2.0	2.2
.....	3.4	.....	4.9	3.8	3.1	4.0	2.8	2.9	2.7	2.1	2.0	2.2
.....	4.3	.....	9.1	3.8	3.4	3.6	2.9	3.0	2.6	2.1	2.0	2.1
.....	3.3	.....	7.5	.....	3.5	.....	3.0	2.9	.....	2.3	.....	2.1

Rating tables for Savannah River, near Calhoun Falls, S. C.

AUGUST 4 TO NOVEMBER 28, 1896.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.75	1,460	2.00	1,850	2.30	2,450	2.60	3,060
1.80	1,575	2.10	2,050	2.40	2,670	2.70	3,280
1.90	1,700	2.20	2,250	2.50	2,870	2.80	3,500

NOVEMBER 29, 1896, TO DECEMBER 31, 1898.[b]

1.60	1,350	2.60	3,240	3.50	7,500	4.40	12,000
1.70	1,450	2.70	3,590	3.60	8,000	4.50	12,500
1.80	1,580	2.80	4,000	3.70	8,500	4.60	13,000
1.90	1,720	2.90	4,500	3.80	9,000	4.70	13,500
2.00	1,875	3.00	5,000	3.90	9,500	4.80	14,000
2.10	2,045	3.10	5,500	4.00	10,000	4.90	14,500
2.20	2,235	3.20	6,000	4.10	10,500	5.00	15,000
2.30	2,445	3.30	6,500	4.20	11,000	6.00	20,000
2.40	2,680	3.40	7,000	4.30	11,500	7.00	25,000
2.50	2,940						

JANUARY 1 TO DECEMBER 31, 1899.[c]

2.00	1,830	3.10	3,790	4.40	9,476	7.50	23,240
2.10	1,916	3.20	4,160	4.60	10,364	8.00	25,460
2.20	1,990	3.30	4,598	4.80	11,552	8.50	27,680
2.30	2,090	3.40	5,036	5.00	12,140	9.00	29,900
2.40	2,190	3.50	5,480	5.20	13,028	9.50	32,120
2.50	2,340	3.60	5,924	5.40	13,916	10.00	34,340
2.60	2,490	3.70	6,768	5.60	14,840	10.50	36,560
2.70	2,680	3.80	6,812	5.80	15,692	11.00	38,780
2.80	2,870	3.90	7,256	6.00	16,580	12.00	43,220
2.90	3,145	4.00	7,700	6.50	18,800	13.00	47,660
3.00	3,420	4.20	8,588	7.00	21,020	14.00	52,100

[a] ove gage height 2.80 feet the following rating table (Nov. 29, 1896, to Dec. 31, 1898) should be used.
[b] ove gage height 2.80 feet the rating curve is a tangent, the difference being 500 per tenth.
[c] ove gage height 3.40 feet the rating curve is a tangent, the difference being 444 per tenth.

Rating tables for Savannah River, near Calhoun Falls, S. C.—Continued.

JANUARY 1 TO DECEMBER 31, 1900.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	1,175	2.90	3,500	4.40	9,990	8.00	25,650
1.50	1,260	3.00	3,900	4.50	10,425	8.50	27,825
1.60	1,350	3.10	4,335	4.60	10,860	9.00	30,000
1.70	1,445	3.20	4,770	4.70	11,295	9.50	32,175
1.80	1,545	3.30	5,205	4.80	11,735	10.00	34,350
1.90	1,650	3.40	5,640	4.90	12,165	11.00	38,700
2.00	1,760	3.50	6,075	5.00	12,600	12.00	43,050
2.10	1,870	3.60	6,510	5.20	13,470	13.00	47,400
2.20	1,990	3.70	6,945	5.40	14,340	14.00	51,750
2.30	2,120	3.80	7,380	5.60	15,210	15.00	56,100
2.40	2,280	3.90	7,815	5.80	16,080	16.00	60,450
2.50	2,470	4.00	8,250	6.00	16,950	17.00	64,800
2.60	2,600	4.10	8,685	6.50	19,125	18.00	69,150
2.70	2,910	4.20	9,120	7.00	21,300	20.00	77,850
2.80	3,150	4.30	9,555	7.50	23,475		

[a] Above gage height 3.00 feet the rating curve is a tangent, the difference being 435 per tenth.

JANUARY 1 TO DECEMBER 31, 1903.[a]

2.00	1,870	2.80	3,930	3.60	6,910	4.40	10,060
2.10	2,050	2.90	4,280	3.70	7,300	4.50	10,470
2.20	2,250	3.00	4,640	3.80	7,690	4.60	10,890
2.30	2,470	3.10	5,010	3.90	8,080	4.70	11,310
2.40	2,710	3.20	5,390	4.00	8,470	4.80	11,740
2.50	2,980	3.30	5,770	4.10	8,860	4.90	12,170
2.60	3,280	3.40	6,150	4.20	9,260	5.00	12,600
2.70	3,600	3.50	6,530	4.30	9,660		

[a] Above gage height 5.00 feet this table is the same as the 1900 table.

Estimated monthly discharge of Savannah River near Calhoun Falls, S. C.

[Drainage area, 2,712 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1896.					
August 4 to 31	5,500	1,525	2,126	0.78	0.81
September	9,250	1,460	2,360	.87	.97
October	2,870	1,460	1,821	.67	.77
November	26,000	1,950	5,644	2.08	2.32
December	18,000	2,560	6,468	2.38	2.75
1897.					
January	17,000	2,235	4,456	1.64	1.89
February	32,750	4,000	11,366	4.19	4.36
March	28,750	3,420	10,950	4.04	4.66
April	56,750	6,000	13,342	4.92	5.49
May	18,000	2,235	6,010	2.22	2.56
June	12,000	2,140	4,698	1.73	1.93
July	10,250	2,445	4,307	1.59	1.83
August	4,750	1,875	2,654	.98	1.13
September	3,800	1,460	1,873	.69	.77
October	5,250	1,405	2,220	.82	.94
November	7,000	1,650	2,820	1.04	1.16
December	5,000	2,445	3,355	1.24	1.43
The year	56,750	1,405	5,671	2.09	28.15
1898.					
January	17,500	2,140	4,500	1.66	1.91
February	6,250	2,340	3,231	1.19	1.24
March	23,750	2,235	3,638	1.34	1.54
April	13,000	2,560	5,396	1.99	2.22
May	4,000	1,580	2,399	.88	1.01
June	2,560	1,520	1,761	.65	.72
July	15,250	1,350	6,314	2.33	2.69
August 1 to 9	15,250	2,940	7,137	2.63	.38

d monthly discharge of Savannah River, near Calhoun Falls, S. C.—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1899.					
31	50,324	7,256	15,185	5.60	5.83
	19,244	3,120	9,632	3.55	3.96
	7,700	3,770	5,798	2.14	2.47
	12,140	3,120	4,922	1.81	2.02
	12,140	1,990	3,184	1.17	1.35
	5,480	2,330	3,031	1.12	1.29
	4,160	1,990	2,870	1.06	1.18
	7,256	1,910	2,549	.94	1.08
	7,700	1,830	2,474	.91	1.01
	12,140	2,190	4,434	1.63	1.88
1900.					
	8,250	3,500	3,961	1.46	1.68
	75,240	2,910	13,362	4.93	5.14
	19,125	5,205	9,485	3.50	4.04
	36,090	5,205	10,048	3.70	4.13
	12,165	3,150	5,235	1.93	2.23
	46,095	2,910	11,427	4.21	4.69
	6,510	1,760	3,019	1.11	1.28
	4,770	1,660	2,700	1.00	1.15
	20,865	1,760	4,230	1.56	1.74
	12,600	1,760	3,819	1.41	1.63
	9,555	2,690	4,531	1.67	1.86
	7,815	3,150	5,659	2.09	2.41
year	75,240	1,660	6,456	2.38	31.98
1903.					
	10,060	5,010	7,777	2.87	3.31
	46,095	7,300	17,551	6.47	6.74
	53,925	8,470	16,244	5.99	6.90
	46,965	7,690	12,325	4.54	5.07
	8,470	4,640	6,216	2.29	2.64
	57,405	4,640	10,071	3.71	4.14
	11,740	3,930	6,623	2.44	2.81
	20,865	4,280	6,265	2.31	2.66
	9,260	2,980	4,402	1.62	1.81
	4,640	2,050	2,878	1.06	1.22
	3,600	1,870	2,301	.85	.95
	2,710	1,870	2,170	.80	.92
year	57,405	1,870	7,902	2.91	39.17

SAVANNAH RIVER AT WOODLAWN, S. C.

station was established November 9, 1905, by M. R. Hall. cated at the Charleston and Western Carolina Railway bridge, eet from the depot at Woodlawn, S. C., 17 miles above Augusta, id 10 miles above the Augusta water-power dam.

flow is almost natural at this point, being affected very slightly red water, mostly from Seneca River. The river is divided by sland into two channels. The east channel is the main part of er, as there is very little water flowing in the west channel at ry stages and probably none at the lowest stage. The channel tically straight at the station. The left bank is high and will erflow except under the short trestle approach. The island e bank for a short distance west of the west channel will over- The current is swift and is good in the greater part of the at low water, but at places it is broken and irregular or is with the direction of the section. The bed of the stream is rock, the considerable roughness of which causes the irregu- in the current above mentioned. Careful measurements give good results at this station.

Discharge measurements are made from the upstream side of the railroad bridge, which is in four spans over the east channel and a single span over the west channel. Across the island between the two channels there is about 900 feet of wooden trestle.

The gage is a boxed chain gage, attached to the upstream end of the second floor beam from the left end of the bridge. The length of the chain is 39 feet. It is read twice each day by M. A. Palmore. The bench mark is the top of the upstream end of the second floor beam from the left end of the bridge; elevation, 37.00 feet above the datum of the gage.

Discharge measurements of Savannah River at Woodlawn, S. C.

Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*
November 9	3.49	3,216
November 21	3.31	3,069

Daily gage height, in feet, of Savannah River at Woodlawn, S. C.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1905.			1905.			1905.		
1		3.65	12	4.1	6.9	22	4.0	14.6
2		3.6	13	3.8	5.6	23	3.75	9.8
3		5.9	14	3.45	5.4	24	3.55	7.3
4		12.1	15	3.55	5.8	25	3.6	6.3
5		9.2	16	3.5	6.2	26	3.6	5.8
6		6.2	17	3.45	5.9	27	3.6	5.4
7		5.0	18	3.45	5.3	28	3.7	5.4
8		4.6	19	3.5	5.0	29	3.75	7.8
9	3.55	5.4	20	3.3	7.2	30	3.7	7.3
10	3.55	11.6	21	3.4	15.5	31		6.2
11	4.1	9.4						

SAVANNAH RIVER AT AUGUSTA.

Since 1875 observations of river heights have been maintained at this station by the city of Augusta at the city highway bridge. The United States Weather Bureau has published the results of observations from 1875 to 1905 in a volume entitled "Stages of Water at River Stations."

The channel is straight for a long distance above and below the bridge and is about 560 feet wide at low water. The banks are high, but will overflow at times under a part of the length of the approaches and, at very high stages, for a long distance on either side of the river beyond the ends of the bridge. The bed of the stream is sandy and undergoes considerable change. The current is swift.

Discharge measurements are made from the downstream side of the North Augusta bridge at Thirteenth street in the city of Augusta. This bridge consists of three spans, each 208 feet long, with 319 feet of wooden approach on the right bank and 259 feet on the left. The initial point for soundings is the end of the bridge at the right bank on the downstream side.

The gage, located at the Fifth Street Bridge, 1 mile below the measuring station, is a vertical timber fastened to the first bridge pier which is in the water on the side of the pier near the upstream corner, facing the right bank. Readings are made four times each day by J. M. Youngblood, keeper of the city bridge, usually at 6 a. m., 12 m., 6 p. m., and 9 p. m. The 6 a. m. readings are those used by the Weather Bureau, but are liable to be very misleading, owing to the great diurnal fluctuation of the water surface, and should not be used for important work. In the publications of the United States Geological Survey since 1900 the average of all four of the daily readings is used and is reduced to feet and tenths of a foot. The zero of the gage is the datum of all the city levels, and any city bench mark can therefore be used. A point is established on the North Augusta bridge from which to measure down with a steel tape. This is the top of the plate through which the top pipe of the bridge fencing passes, which is riveted to the right side of the intermediate post at the downstream end of the third floor beam from the right-bank end of the bridge, and at ordinary stages it is 55.00 feet above water, less the reading of the gage.

This station is located below all the wheels of the large developed water power belonging to the city of Augusta.

Water is diverted from the river above the city by a canal following along the right bank, described in Volume XVI of the Tenth Census, 1880, page 789. A measurement of the canal by B. M. Hall on September 29, 1897, above all the water wheels, showed a flow of 2,640 second-feet, presumably all of which was passing through the water wheels under varying heads. The full head is 50 feet, but the canal has three levels. Some of the wheels discharge from the upper level or main canal directly into the river, while others discharge from one level to another.

The highest water recorded was on September 11, 1888, at 38.7 feet. At that time the entire city was submerged, 10 persons were drowned, and property was damaged to the amount of $2,000,000.

The floods of this river have been investigated under the direction of the Corps of Engineers, United States Army, and reports prepared by George W. Brown, assistant engineer. The first of these, dated February 11, 1889, was printed, with maps, as House Ex. Doc. No. 213, Fifty-first Congress, first session; it was also given, with few maps, in the Report of the Chief of Engineers, United States Army, 1890, page 1340. A later report, dated June 10, 1890, also prepared by Mr. George W. Brown, was printed as Ex. Doc. No. 255, Fifty-first Congress, second session. In this report is given a rating table, showing the probable discharge of the river at heights on the gage of from 5 to 40 feet. On page 17 of this latter document is shown the run-off in cubic feet per second per square mile for various portions of the drainage basin. A table of distances and elevations and

slope of river, as well as a description of the character of the drainage basin, is also given.

From the figures in the above-named reports a computation was made by Cyrus C. Babb of the fluctuations of flow of Savannah River, the results being published in the Fourteenth Annual Report, Part II, of the United States Geological Survey, page 147, relating to the years 1884 to 1891, inclusive. A discussion of the results is also given in Transactions American Society of Civil Engineers, Volume XXIII, page 332.

By the use of a rating table Mr. Hall has computed the minimum flow, by months, from 1892 to 1898, inclusive. In each case he has taken the average of all the readings for the day of lowest water in the given month, and not the lowest single reading. The lowest average daily reading for the seven years is that on July 3, 1898, of 3.88.

Minimum monthly gage height and discharge of Savannah River at Augusta, for 1892 to 1898, inclusive.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1892.	*Feet.*	*Sec.-ft.*	1895.	*Feet.*	*Sec.-ft.*
January 2	7.80	6,820	July 21	6.66	5,905
February 7	8.55	8,328	August 3	5.90	3,910
March 6	8.25	7,698	September 30	5.40	3,406
April 30	8.63	8,502	October 26	5.03	3,125
May 2	7.30	5,922	November 2	5.20	3,208
June 30	7.53	6,358	December 8	5.40	3,406
July 17	6.76	5,033			
August 10	6.06	4,091	1896.		
September 21	6.40	4,522	January 15	6.50	4,660
October 2	6.30	4,589	February 28	8.10	7,396
November 2	6.80	5,092	March 31	7.50	6,274
December 15	6.63	4,843	April 24	6.03	4,049
			May 23	5.30	3,352
1893.			June 18	4.93	3,045
January 18	6.45	4,591	July 4	4.73	2,875
February 10	8.06	7,318	August 25	5.16	3,200
March 31	8.00	7,200	September 23	4.10	2,405
April 20	6.30	4,589	October 11	3.94	2,323
May 29	6.35	4,455	November 1	4.80	2,930
June 30	6.70	4,944	December 27	6.16	4,158
July 15	5.53	3,550			
August 26	5.23	3,296	1897.		
September 26	6.86	5,200	January 12	6.00	4,039
October 31	6.06	4,091	February 1	7.40	6,068
November 21	5.73	3,735	March 6	9.20	9,804
December 15	6.30	4,589	April 29	8.60	8,406
			May 29	6.60	4,800
1894.			June 27	6.00	4,020
January 6	7.10	5,572	July 4	5.65	3,655
February 4	7.76	6,760	August 31	5.40	3,406
March 31	8.13	7,456	September 15	4.55	2,758
April 28	7.23	5,810	October 10	3.93	2,300
May 31	6.36	4,484	November 14	5.00	3,100
June 18	5.33	3,380	December 12	5.85	3,800
July 16	5.25	3,296			
August 24	5.90	3,910	1898.		
September 13	5.30	3,352	January 11	5.97	3,900
October 31	5.83	3,840	February 26	5.67	3,685
November 12	5.76	3,765	March 27	5.67	3,670
December 3	5.53	3,550	April 23	6.97	5,350
			May 29	4.92	3,032
1895.			June 11	4.20	2,475
January 8	7.75	6,728	July 3	3.88	2,294
February 10	8.66	8,506	August 4	6.55	4,730
March 1	8.95	9,220	September 30	7.47	6,220
April 7	8.76	8,800	October 2	7.02	5,435
May 18	8.70	8,656	November 6	7.55	6,364
June 27	6.73	5,040	December 18	7.85	6,916

Discharge measurements of Savannah River at Augusta.

Date.	Gage height.	Discharge.
1896.	*Feet.*	*Sec.-ft.*
October 3	5.41	3,154
1897.		
July 15	6.67	4,198
September 9	5.17	3,180
November 6	6.20	4,311
1898.		
April 28	11.55	14,400
June 16	5.25	3,393
July 27	9.85	11,380
July 28	10.37	14,280
August 2	7.17	6,302
August 3	6.72	5,511
September 3	28.27	87,470
September 16	8.10	7,432
September 17	8.00	7,108
November 14	11.68	13,240
1899.		
March 17	25.20	60,720
March 18	20.60	35,970
May 8	9.70	10,860
May 9	9.50	9,908
May 29	7.60	6,271
July 1	7.22	5,391
August 3	6.68	4,226
October 10	12.48	14,610
1900.		
August 28	7.30	5,968
1901.	*Feet.*	*Sec.-ft.*
January 19	11.65	13,040
February 21	8.55	7,664
April 4	32.10	127,100
August 10	10.00	9,720
1902.		
June 20	8.85	7,497
July 25	7.85	5,246
September 5	7.90	5,239
1903.		
June 10	15.10	17,740
September 29	7.13	3,831
December 3	7.20	3,898
1904.		
February 5	7.50	4,714
February 15	8.70	6,714
April 7	7.96	5,647
July 14	6.45	3,826
August 10	24.57	55,680
October 9	5.77	3,068
October 18	5.07	2,057
1905.		
March 29	7.72	5,333
April 12	8.04	5,867
June 7	7.35	5,092
October 13	10.10	9,882
October 14	7.78	5,204
November 22	6.70	4,365

Daily gage height, in feet, of Savannah River at Augusta.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.[a]												
1	8.5	12.7	28.8	19.5	9.6	7.9	7.2	7.4	13.9	5.0	6.2	7.3
2	10.8	13.0	21.0	18.9	9.5	8.4	6.7	6.7	10.9	5.0	6.4	6.9
3	10.3	14.3	16.2	15.3	9.3	7.6	6.2	6.3	9.1	5.5	6.3	5.8
4	9.0	15.8	14.2	13.2	9.3	7.5	6.0	6.3	8.0	5.6	5.8	7.0
5	8.5	14.5	13.7	12.9	9.2	7.2	6.0	6.0	7.5	5.8	5.6	8.7
6	8.5	20.7	16.2	13.0	9.8	7.3	6.0	5.9	6.9	11.8	5.8	6.7
7	12.8	28.0	15.2	12.2	10.3	7.3	5.8	5.7	6.6	9.6	5.9	6.3
8	22.9	31.0	13.3	12.4	10.4	7.0	6.7	5.5	7.4	10.5	5.8	6.3
9	19.2	29.9	12.2	15.5	9.7	7.0	7.0	5.7	7.0	14.1	5.9	6.1
10	14.3	22.9	11.8	14.2	9.1	6.9	8.3	6.0	7.0	12.1	5.8	6.0
11	12.8	18.3	11.5	12.8	8.8	7.3	7.8	5.7	8.7	8.5	5.5	5.9
12	17.3	14.7	11.2	12.0	8.5	6.9	6.5	8.0	9.3	7.3	5.6	5.9
13	17.4	13.7	11.2	11.5	8.5	7.5	6.0	8.3	8.6	6.9	5.6	6.3
14	15.3	12.9	11.1	11.2	8.5	9.7	6.0	6.4	6.9	6.4	5.7	10.7
15	15.4	12.3	11.0	11.0	8.3	9.7	6.0	6.0	6.3	6.0	6.1	14.5
16	14.5	14.4	18.8	10.8	8.2	8.2	6.0	5.5	5.8	6.3	5.8	10.5
17	17.3	25.0	25.5	10.5	8.2	8.0	5.7	5.4	5.6	6.0	5.8	8.5
18	16.8	24.3	21.5	10.5	8.0	8.7	5.6	5.0	5.2	6.0	5.8	7.5
19	13.9	19.1	17.1	10.2	8.0	7.9	5.8	5.0	5.4	6.3	5.4	7.3
20	11.7	15.3	20.0	10.5	7.9	7.3	5.7	5.8	5.7	6.1	5.7	7.0
21	10.7	13.5	22.5	10.4	7.9	7.3	5.5	4.0	6.0	6.5	5.7	6.8
22	10.0	14.7	17.1	10.0	7.8	7.0	5.3	4.7	6.6	6.7	5.8	6.9
23	9.9	14.3	15.8	9.9	7.7	6.7	5.8	5.3	6.0	6.0	5.8	7.4
24	11.4	13.0	15.5	9.6	8.2	6.7	5.8	4.8	5.4	6.0	7.0	9.3
25	11.9	11.7	15.5	10.0	8.0	6.5	5.7	5.7	5.9	5.8	8.3	13.8
26	10.8	11.5	13.8	11.5	7.8	6.3	6.0	5.6	5.6	5.8	9.2	12.3
27	10.3	17.7	14.5	13.0	7.6	6.7	7.0	7.0	5.3	5.6	11.3	9.8
28	10.0	29.6	13.0	11.2	7.4	7.5	11.7	13.3	5.8	5.7	9.8	8.3
29	11.0	.....	14.0	10.3	7.4	7.7	11.6	11.3	5.8	5.6	8.4	5.0
30	11.2	.....	15.5	10.0	7.4	7.5	9.3	9.2	5.6	5.8	7.5	8.3
31	10.5	.....	13.0	.....	7.3	.....	8.5	11.4	.....	5.9	.....	7.7

[a] For the months of September, October, and November, 1899, the figures given are an average of four readings daily—6 a. m., 12 m., 6 p. m., and 8 p. m. For the other months the readings are those taken at 6 a. m.

Daily gage height, in feet, of Savannah River at Augusta—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov
1900.[a]											
1	7.12	6.87	17.37	9.98	11.5	7.7	14.46	11.29	7.37	6.18	7.2
2	6.94	6.81	23.12	9.89	11.2	7.5	12.9	9.46	7.79	6.38	7.3
3	6.67	6.44	13.87	9.54	10.7	7.5	12.25	8.3	8.35	6.38	7.7
4	6.42	6.52	14.06	9.54	12.3	8.3	11.66	7.76	7.33	6.16	13.8
5	6.5	8.33	11.44	9.65	10.6	10.2	10.6	7.73	7.0	6.4	12.0
6	6.67	9.1	10.6	9.63	9.6	9.5	9.62	7.33	6.85	6.65	9.3
7	6.39	8.89	10.37	9.2	9.3	11.7	9.27	7.27	6.44	7.65	8.0
8	6.65	8.08	10.64	9.0	9.0	19.7	8.96	7.19	6.2	7.41	7.7
9	6.71	8.12	17.35	8.75	9.0	19.9	8.79	7.13	6.27	7.35	7.5
10	6.71	10.04	17.6	8.9	8.8	19.9	8.39	7.09	5.89	7.5	7.4
11	7.12	20.58	14.35	9.15	8.7	10.8	8.52	7.06	6.16	6.3	6.9
12	10.4	27.19	12.21	11.1	8.6	9.5	8.22	6.57	6.06	6.75	7.0
13	15.0	29.6	10.96	11.35	8.4	9.2	8.68	6.62	6.08	6.85	7.1
14	12.79	32.31	10.39	10.77	8.3	9.3	8.94	7.31	5.99	7.48	7.0
15	9.37	30.08	10.08	9.47	8.3	9.9	9.6	7.17	7.4	7.14	7.0
16	8.65	22.08	15.25	9.16	8.2	9.7	9.37	6.77	14.49	6.62	6.8
17	8.12	16.29	17.27	8.88	7.8	15.0	8.64	7.67	14.24	6.56	6.8
18	7.67	12.75	14.21	12.15	8.4	19.8	8.37	7.27	10.6	6.47	6.5
19	7.94	11.39	11.42	23.89	9.7	18.4	8.19	6.78	8.35	6.45	6.8
20	8.94	10.46	13.68	24.7	11.0	13.5	8.04	6.82	7.7	6.27	7.2
21	10.26	10.35	15.25	24.25	10.6	10.7	7.89	6.62	7.27	5.95	7.5
22	10.44	14.79	13.7	26.73	8.9	9.6	7.39	6.48	7.12	6.3	7.4
23	9.11	15.44	11.85	24.73	8.4	11.7	8.0	6.5	6.92	6.32	7.3
24	8.44	12.89	11.73	18.27	10.4	21.8	8.2	6.56	6.35	12.66	7.4
25	8.12	12.96	14.10	14.75	13.0	29.2	8.92	6.77	6.75	16.72	7.0
26	7.96	12.37	19.65	17.08	11.0	26.8	8.32	7.77	6.5	12.3	10.0
27	7.73	10.98	18.37	13.73	9.1	23.0	9.23	7.12	6.67	10.6	14.9
28	7.19	10.31	14.79	12.5	8.5	19.6	11.12	7.2	6.46	9.72	11.8
29	7.22	.....	12.67	11.81	8.1	16.7	10.2	6.69	6.5	8.52	9.1
30	7.2	.....	11.46	11.2	7.9	14.6	11.88	6.62	6.19	7.95	8.3
31	7.08	.....	10.69	.....	7.8	.....	13.35	7.08	.....	7.6	.....
1901.[a]											
1	15.2	10.4	8.3	14.0	10.1	14.1	12.2	8.3	18.4	10.8	8.4
2	15.28	9.5	8.2	14.7	10.0	13.3	11.6	7.8	18.2	11.9	8.4
3	17.3	10.0	8.0	30.3	9.8	11.4	9.9	7.4	15.0	12.2	8.3
4	15.12	25.6	8.2	30.9	9.5	10.1	8.9	7.2	12.8	12.1	8.5
5	12.4	26.7	8.1	23.8	9.4	9.8	8.8	7.3	11.4	10.1	8.4
6	10.28	20.4	8.0	18.5	9.3	9.8	8.5	7.7	10.8	9.4	8.7
7	9.37	16.1	8.0	14.3	9.3	15.0	8.3	12.9	10.4	9.3	8.5
8	8.95	12.7	7.8	12.7	9.3	15.7	8.6	18.9	10.0	9.1	8.4
9	8.62	14.0	7.8	11.6	9.2	12.1	9.0	13.2	9.9	9.2	8.5
10	8.55	17.3	8.1	11.0	9.0	9.6	8.9	10.0	9.8	8.9	8.3
11	8.55	15.3	10.1	10.6	8.8	9.0	8.7	9.2	9.7	8.7	8.4
12	17.12	12.7	14.9	10.3	8.5	9.1	8.2	12.0	10.0	8.8	8.5
13	23.45	11.6	11.8	10.5	8.6	10.4	7.7	10.6	9.8	11.2	8.7
14	19.18	10.7	9.8	17.6	8.7	21.7	8.1	11.3	9.6	12.0	8.4
15	14.65	10.2	8.9	18.6	8.6	26.9	8.4	18.1	9.3	10.8	8.5
16	11.8	9.8	8.6	14.9	8.5	26.2	9.2	19.8	9.2	9.1	8.5
17	11.9	9.3	8.2	12.4	8.5	23.0	8.7	22.4	10.7	9.0	8.2
18	13.3	9.2	8.2	11.3	8.3	17.8	9.3	21.8	28.5	8.9	8.5
19	11.55	9.1	8.0	11.7	8.9	14.8	9.7	19.7	30.9	8.6	8.4
20	9.87	8.9	8.0	19.6	15.1	12.1	13.3	17.9	25.5	8.4	8.4
21	9.48	8.6	8.0	23.6	20.8	11.0	12.4	15.8	17.1	8.2	8.5
22	9.05	8.6	8.7	18.2	25.6	11.2	9.8	17.0	13.1	8.4	8.6
23	9.0	8.6	9.4	14.8	27.0	11.7	9.0	20.2	11.5	8.4	8.6
24	9.07	8.6	8.6	13.3	10.6	12.2	8.2	24.0	10.7	8.6	8.4
25	10.28	8.7	8.9	12.4	15.0	11.7	8.0	21.6	10.2	8.7	8.8
26	10.32	8.7	15.1	11.7	13.5	11.8	8.0	16.8	10.0	8.5	8.6
27	9.47	8.7	27.7	11.2	14.0	11.0	10.0	13.9	9.7	8.5	8.5
28	9.12	8.4	28.0	10.8	11.9	10.2	9.8	22.0	9.3	8.6	8.4
29	9.05	.....	20.3	10.5	11.1	10.8	9.3	28.7	9.8	8.3	8.4
30	8.95	.....	14.8	10.2	10.4	10.9	9.1	26.1	10.7	8.4	8.3
31	9.85	.....	14.4	.....	10.8	.....	8.4	21.4	.....	8.6	.....

[a] Mean of four daily readings.

Daily gage height, in feet, of Savannah River at Augusta—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May	June.	July	Aug.	Sept.	Oct.	Nov.	Dec.
1902.a												
.....	23.9	19.3	33.8	18.6	9.8	8.3	7.3	7.8	7.7	8.7	7.5	11.8
.....	16.6	29.5	33.3	14.5	10.6	8.5	7.2	8.1	7.4	9.9	7.2	13.2
.....	13.6	32.4	28.6	13.1	10.8	8.9	7.1	9.0	7.3	9.2	7.1	17.4
.....	12.4	28.5	21.5	12.8	10.2	8.5	7.0	8.5	7.2	8.5	7.3	21.1
.....	11.5	21.1	17.4	12.5	9.9	8.4	6.9	7.8	7.8	9.2	7.1	17.4
.....	11.0	15.6	15.1	12.0	9.8	8.3	6.8	7.7	7.7	10.9	7.4	14.3
.....	10.5	13.2	13.9	12.0	9.7	8.3	6.9	7.7	7.1	10.3	7.5	11.8
.....	10.5	12.2	13.2	13.4	9.4	8.5	7.0	7.6	7.1	8.7	9.2	10.5
.....	10.4	11.6	12.7	13.6	9.6	8.8	7.4	7.2	7.1	8.3	8.3	9.5
.....	10.2	11.0	13.1	12.3	10.1	8.6	8.0	7.1	12.3	8.1	8.0	9.1
.....	9.9	10.7	12.5	11.6	10.6	8.1	8.0	7.4	13.1	8.0	7.5	9.0
.....	9.8	10.4	12.3	11.1	9.6	8.1	8.3	8.6	9.9	8.0	7.4	8.9
.....	9.6	10.2	12.3	10.6	9.1	8.1	9.6	8.8	8.3	8.8	7.5	10.7
.....	9.4	10.2	13.7	11.1	9.1	8.1	9.4	8.0	7.7	9.4	7.4	10.6
.....	9.3	10.3	13.5	10.6	9.7	8.4	8.7	9.5	8.9	8.9	7.3	9.7
.....	9.4	10.7	18.5	10.8	9.4	13.0	10.0	10.4	8.0	9.2	7.2	8.9
.....	9.2	11.4	27.9	11.2	9.3	15.0	9.2	9.4	7.7	8.4	7.4	9.2
.....	9.2	11.1	25.6	13.1	9.2	11.4	8.7	9.2	7.4	8.0	8.0	14.0
.....	9.2	10.9	19.5	13.4	9.2	10.4	7.6	8.3	7.4	7.3	8.7	11.5
.....	9.2	10.6	16.0	12.7	9.2	9.4	7.1	8.9	8.0	7.5	8.8	10.2
.....	9.5	11.8	13.8	12.1	9.2	9.3	6.9	8.1	9.2	7.9	8.0	9.4
.....	10.2	14.5	13.1	11.1	9.4	8.9	6.9	7.3	8.4	7.4	7.9	12.2
.....	10.2	13.7	12.5	10.7	9.5	8.6	6.9	7.4	8.1	7.2	7.4	14.6
.....	9.7	12.6	12.4	10.5	9.2	8.5	7.0	7.4	7.8	7.2	7.5	12.2
.....	9.5	16.7	11.9	10.2	8.9	8.4	7.5	7.3	7.9	7.2	7.7	10.4
.....	9.3	18.1	12.0	10.2	8.8	8.3	7.6	7.4	13.6	7.0	10.1	9.9
.....	9.3	16.2	11.6	10.0	8.6	7.9	7.6	7.4	13.8	7.4	12.4	9.4
.....	9.2	25.5	11.9	10.1	8.5	7.8	7.0	7.4	12.8	8.9	10.8	8.9
.....	9.9	.....	19.6	9.8	8.4	7.5	7.0	8.7	10.9	8.9	9.1	8.6
.....	11.6	.....	28.2	9.9	8.3	7.6	7.8	8.4	9.3	8.2	8.4	8.9
.....	11.4	.....	24.6	.....	8.2	.....	8.0	7.5	.....	7.8	.....	9.7
1903.a												
.....	9.7	10.2	26.7	23.4	10.6	11.0	9.7	9.0	7.4	7.1	6.8	7.0
.....	9.4	9.6	24.0	18.7	10.5	16.3	9.4	8.9	7.2	7.0	7.2	7.2
.....	11.2	9.7	18.4	16.1	10.5	20.0	9.0	12.0	7.3	7.0	8.3	7.2
.....	13.8	10.8	14.9	15.2	10.6	15.3	9.5	13.6	7.3	6.9	9.1	7.1
.....	13.9	18.5	13.9	14.6	12.4	13.2	9.6	11.7	7.4	7.1	9.1	7.0
.....	12.2	18.2	13.7	13.9	11.3	19.9	10.6	10.6	7.2	6.9	9.4	7.0
.....	10.7	14.6	13.7	13.0	10.7	24.7	10.0	9.5	7.1	7.1	8.8	7.1
.....	9.9	30.7	13.3	13.3	10.5	25.5	10.1	8.6	7.2	7.1	8.0	7.2
.....	9.5	33.0	15.0	16.8	10.5	17.7	9.5	8.1	7.3	7.2	7.8	7.3
.....	9.2	28.7	15.1	17.5	10.4	15.6	9.2	8.1	7.2	7.5	7.6	7.4
.....	9.2	24.1	14.9	14.9	10.4	16.1	9.2	8.1	8.3	7.4	7.6	7.4
.....	11.7	28.4	18.2	13.3	10.0	16.1	9.9	10.0	7.8	7.3	7.5	7.4
.....	14.1	26.5	19.0	13.1	10.0	15.0	10.0	9.1	7.2	7.0	7.5	7.1
.....	12.2	20.4	15.3	20.4	10.4	12.1	13.2	8.3	7.4	7.0	7.5	7.2
.....	10.6	16.0	13.8	23.6	11.2	11.2	13.4	9.5	8.2	6.9	7.3	7.4
.....	9.9	14.4	13.2	17.8	12.9	10.6	11.0	9.8	9.4	6.9	7.3	7.6
.....	9.6	25.9	12.7	14.6	11.7	10.1	9.5	10.3	11.9	7.3	7.3	7.5
.....	9.3	29.1	12.2	13.6	10.5	9.8	8.9	9.9	10.8	9.2	7.5	7.3
.....	9.2	23.4	11.9	12.7	9.9	9.7	8.7	17.7	9.0	8.4	7.6	7.2
.....	9.1	18.6	11.8	12.5	9.6	9.6	8.4	14.8	8.1	8.2	7.8	7.0
.....	9.1	14.6	12.0	12.3	9.5	9.8	8.2	11.3	8.2	7.6	7.7	7.1
.....	9.2	13.1	18.2	12.3	9.4	10.4	8.2	9.9	7.6	7.4	7.3	7.4
.....	9.0	12.6	25.5	11.9	9.5	9.8	8.1	8.7	7.5	7.0	7.3	7.9
.....	9.0	12.1	29.4	11.5	9.2	9.4	8.1	8.4	7.4	7.1	7.3	7.6
.....	9.1	11.7	28.6	11.1	9.2	9.4	8.0	8.3	7.4	6.8	7.4	7.4
.....	9.9	11.5	22.5	11.4	9.0	9.3	7.6	8.0	7.4	7.0	7.3	7.7
.....	10.2	11.6	17.1	11.7	8.7	9.7	7.9	7.8	7.2	7.0	7.3	8.0
.....	10.9	16.9	15.2	11.5	8.8	10.7	8.0	7.6	7.2	6.9	7.1	8.0
.....	10.9	.....	14.8	11.0	9.4	12.9	7.7	7.6	7.1	6.9	7.0	7.6
.....	11.8	.....	25.3	10.7	9.6	11.0	8.0	7.5	7.1	7.0	7.1	7.5
.....	11.2	.....	27.3	.....	9.7	.....	8.7	7.5	.....	7.0	.....	7.5

a Mean of four daily readings.

Daily gage height, in feet, of Savannah River at Augusta—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.[a]												
1	7.3	8.0	8.8	8.6	7.4	9.2	6.8	7.7	7.3	5.3	5.1	5.7
2	7.2	7.9	8.6	8.6	7.5	11.2	7.5	7.1	7.0	4.8	4.8	6.0
3	7.1	7.9	8.6	8.3	7.3	9.1	6.8	8.9	7.0	5.3	5.4	6.1
4	7.2	7.7	8.7	8.2	7.3	7.9	5.8	8.6	6.2	5.2	5.4	6.9
5	7.3	7.6	8.4	8.1	7.6	7.0	6.4	10.4	9.3	4.9	5.6	7.3
6	7.2	7.7	8.1	8.0	7.5	6.9	6.0	8.6	11.1	5.0	6.3	8.4
7	7.1	7.4	10.4	7.9	7.3	7.0	5.5	8.4	10.4	5.3	6.7	11.5
8	6.8	9.0	16.3	8.2	7.0	7.5	5.6	16.3	8.1	4.7	6.5	9.4
9	7.0	11.9	16.2	9.1	8.8	8.0	5.1	24.5	7.3	3.8	6.4	8.1
10	7.0	11.2	12.6	10.1	8.9	7.1	6.2	24.5	7.0	5.5	6.0	7.7
11	7.3	14.4	10.5	9.3	8.9	6.0	7.0	19.1	6.5	5.2	5.6	7.2
12	7.4	12.7	9.7	8.7	8.0	6.0	6.9	14.3	6.7	4.1	5.5	7.2
13	7.6	10.7	9.3	8.4	7.6	6.7	6.7	11.8	6.4	5.2	5.4	7.0
14	7.4	9.2	9.1	8.2	7.5	6.6	6.3	9.6	6.3	4.6	6.6	7.1
15	7.5	8.7	9.1	8.0	7.0	6.5	5.7	9.3	6.1	4.5	6.8	7.0
16	7.5	8.6	9.4	8.0	7.1	6.4	5.4	10.3	6.1	3.8	7.0	7.0
17	7.2	8.4	9.0	7.8	7.2	6.2	4.8	10.7	5.8	5.5	6.7	6.9
18	7.5	8.2	8.4	8.0	7.0	6.0	5.6	9.1	5.5	4.3	6.3	7.4
19	7.7	8.1	8.4	8.0	7.0	5.2	5.4	8.3	5.7	4.5	5.9	7.6
20	7.6	8.9	8.2	7.9	6.8	6.5	5.5	7.6	5.5	4.3	5.4	7.1
21	7.4	11.6	8.3	7.8	6.8	6.6	5.3	10.1	5.5	5.1	6.3	7.1
22	7.6	14.6	8.5	7.7	6.5	7.1	5.2	9.0	5.6	4.2	5.8	6.6
23	13.1	18.5	9.6	7.7	6.7	7.2	5.0	7.4	5.7	3.8	5.4	6.8
24	13.4	15.7	11.1	7.5	6.6	6.7	10.1	7.1	5.6	5.5	5.9	6.3
25	11.5	12.5	13.4	7.5	6.4	6.1	7.7	6.9	5.5	4.8	6.2	6.1
26	9.4	10.6	11.9	7.6	6.4	5.4	8.7	6.8	5.7	4.8	5.9	6.4
27	8.5	9.5	10.5	7.6	6.4	6.2	7.8	9.2	5.4	4.2	5.6	6.4
28	8.2	9.1	10.4	7.9	6.4	5.7	7.6	12.5	5.5	5.4	6.2	7.8
29	8.2	9.0	9.6	7.8	5.6	5.7	9.5	12.4	5.6	5.3	5.7	9.7
30	8.0	.....	9.1	7.6	5.6	6.6	8.5	9.9	5.3	3.8	5.4	9.9
31	7.9	.....	8.8	.....	6.8	.....	6.8	8.0	.....	5.6	.....	8.3
1905.[a]												
1	7.5	7.2	9.6	7.6	6.6	8.1	11.3	6.8	7.1	5.0	6.2	8.7
2	7.6	7.1	9.4	7.6	8.6	7.9	22.6	6.9	7.0	5.8	6.1	8.1
3	7.5	7.2	9.1	7.5	8.3	7.7	20.2	7.0	9.2	5.3	6.1	8.1
4	7.3	7.0	8.8	7.5	10.9	7.1	12.3	6.9	9.5	5.6	5.9	20.6
5	7.2	7.2	8.6	7.5	12.3	7.2	9.6	6.7	8.2	6.4	6.0	20.2
6	7.2	7.1	9.0	7.8	11.0	7.2	9.5	6.4	7.6	7.5	6.3	12.6
7	7.5	7.3	8.1	8.1	11.5	7.0	13.1	6.7	7.1	6.6	6.1	9.3
8	8.6	9.0	8.2	8.2	18.1	7.1	12.1	7.3	6.9	5.4	5.6	8.4
9	8.8	13.4	8.5	7.4	15.0	6.8	10.4	9.1	6.8	6.0	6.2	9.4
10	8.0	16.9	8.5	7.7	12.1	6.6	9.3	11.1	6.5	5.8	6.1	19.0
11	7.7	17.2	8.7	8.3	10.0	6.2	8.1	9.3	6.8	6.3	6.4	18.2
12	7.7	16.4	10.6	7.9	9.0	6.7	11.5	12.6	6.6	6.6	7.6	14.0
13	12.0	23.5	12.3	8.5	8.3	6.4	18.4	13.8	6.3	9.8	7.2	10.6
14	17.9	25.3	9.8	8.8	7.9	6.6	20.7	13.3	6.6	7.9	6.5	9.4
15	14.2	20.9	9.9	8.4	7.9	7.4	16.5	10.6	7.0	6.7	6.3	9.9
16	10.8	16.3	9.3	8.2	7.8	7.6	13.1	9.5	6.7	6.8	6.4	11.2
17	9.2	12.5	8.9	8.2	7.9	7.4	11.1	9.6	5.9	6.5	6.3	10.4
18	8.7	10.8	8.6	7.3	9.4	7.7	9.3	9.4	6.5	6.5	6.2	9.6
19	8.4	10.2	8.5	7.4	8.2	7.8	9.5	8.8	6.3	6.4	5.6	9.1
20	8.2	10.1	8.4	7.4	7.6	7.5	9.3	8.5	5.6	6.5	6.2	10.2
21	8.3	18.0	8.4	7.4	7.4	7.1	9.1	8.5	6.2	6.0	6.1	27.6
22	8.2	23.5	8.7	7.1	7.8	7.1	8.4	7.8	6.1	5.8	6.5	27.5
23	8.2	20.2	9.0	6.9	8.4	7.8	7.6	7.9	6.1	6.5	7.0	21.5
24	8.0	15.6	8.6	6.9	14.6	7.8	7.9	8.7	5.4	5.8	6.4	16.2
25	7.7	12.4	8.2	6.9	14.2	6.9	7.6	9.2	5.8	6.1	6.4	12.4
26	7.5	11.4	8.4	7.0	11.4	6.9	7.6	10.9	5.7	5.9	5.4	10.8
27	7.2	10.7	8.4	7.0	9.7	6.8	7.5	10.5	5.9	5.9	6.5	9.8
28	7.0	9.7	7.6	7.3	9.5	6.6	7.3	9.0	5.7	6.1	6.3	9.7
29	6.8	.....	7.6	7.7	9.6	6.8	7.6	8.1	5.6	6.5	6.4	14.3
30	7.2	.....	7.8	9.2	9.4	6.5	7.7	7.7	5.2	6.4	6.3	14.0
31	7.2	.....	7.5	.....	8.7	.....	7.9	7.2	.....	6.1	.....	12.9

[a] Mean of four daily readings.

Rating tables for Savannah River at Augusta.

JANUARY 1, 1899, TO DECEMBER 31, 1901.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	1,930	6.20	4,240	9.10	8,570	14.00	17,900
3.40	1,990	6.30	4,360	9.20	8,740	14.20	18,340
3.50	2,050	6.40	4,490	9.30	8,910	14.40	18,780
3.60	2,110	6.50	4,620	9.40	9,080	14.60	19,220
3.70	2,170	6.60	4,750	9.50	9,250	14.80	19,660
3.80	2,230	6.70	4,880	9.60	9,420	15.00	20,100
3.90	2,290	6.80	5,020	9.70	9,590	15.50	21,250
4.00	2,350	6.90	5,160	9.80	9,760	16.00	22,400
4.10	2,410	7.00	5,300	9.90	9,930	16.50	23,600
4.20	2,470	7.10	5,450	10.00	10,100	17.00	24,800
4.30	2,530	7.20	5,600	10.20	10,460	17.50	26,050
4.40	2,595	7.30	5,750	10.40	10,820	18.00	27,300
4.50	2,660	7.40	5,900	10.60	11,180	18.50	28,700
4.60	2,725	7.50	6,050	10.80	11,540	19.00	30,100
4.70	2,790	7.60	6,200	11.00	11,900	19.50	31,700
4.80	2,860	7.70	6,350	11.20	12,280	20.00	33,300
4.90	2,930	7.80	6,500	11.40	12,660	21.00	36,900
5.00	3,000	7.90	6,650	11.60	13,040	22.00	41,000
5.10	3,080	8.00	6,800	11.80	13,420	23.00	45,800
5.20	3,160	8.10	6,960	12.00	13,800	24.00	52,000
5.30	3,250	8.20	7,120	12.20	14,200	25.00	60,000
5.40	3,340	8.30	7,280	12.40	14,600	26.00	68,800
5.50	3,440	8.40	7,440	12.60	15,000	27.00	77,600
5.60	3,540	8.50	7,600	12.80	15,400	28.00	86,400
5.70	3,650	8.60	7,660	13.00	15,800	29.00	95,200
5.80	3,760	8.70	7,920	13.20	16,220	30.00	104,000
5.90	3,880	8.80	8,080	13.40	16,640	31.00	112,800
6.00	4,000	8.90	8,240	13.60	17,060	32.00	121,600
6.10	4,120	9.00	8,400	13.80	17,480		

JANUARY 1, 1902, TO DECEMBER 31, 1903.[a]

6.80	3,400	8.40	6,400	10.00	9,600	11.60	12,860
7.00	3,740	8.60	6,800	10.20	10,000	11.80	13,280
7.20	4,100	8.80	7,200	10.40	10,400	12.00	13,700
7.40	4,460	9.00	7,600	10.60	10,800	12.20	14,120
7.60	4,840	9.20	8,000	10.80	11,200	12.40	14,540
7.80	5,220	9.40	8,400	11.00	11,600	12.60	14,960
8.00	5,600	9.60	8,800	11.20	12,020	12.80	15,380
8.20	6,000	9.80	9,200	11.40	12,440	13.00	15,800

JANUARY 1 TO DECEMBER 31, 1904.

3.80	1,450	5.20	2,360	10.50	9,150	17.00	23,700
3.90	1,500	5.40	2,520	11.00	10,050	17.50	25,120
4.00	1,550	5.60	2,690	11.50	10,980	18.00	26,600
4.10	1,610	5.80	2,870	12.00	11,950	18.50	28,170
4.20	1,670	6.00	3,050	12.50	12,950	19.00	29,800
4.30	1,730	6.50	3,550	13.00	14,000	19.50	31,470
4.40	1,790	7.00	4,100	13.50	15,080	20.00	33,200
4.50	1,850	7.50	4,680	14.00	16,200	21.00	36,900
4.60	1,920	8.00	5,300	14.50	17,350	22.00	41,000
4.70	1,990	8.50	5,980	15.00	18,550	23.00	45,800
4.80	2,060	9.00	6,700	15.50	19,780	24.00	52,000
4.90	2,130	9.50	7,480	16.00	21,050	25.00	60,000
5.00	2,200	10.00	8,300	16.50	22,350		

JANUARY 1 TO DECEMBER 31, 1905.[b]

5.00	2,650	5.90	3,400	6.80	4,300	7.70	5,340
5.10	2,725	6.00	3,495	6.90	4,410	7.80	5,470
5.20	2,800	6.10	3,590	7.00	4,520	7.90	5,600
5.30	2,880	6.20	3,690	7.10	4,630	8.00	5,740
5.40	2,960	6.30	3,790	7.20	4,740	8.10	5,890
5.50	3,045	6.40	3,890	7.30	4,860	8.20	6,050
5.60	3,130	6.50	3,990	7.40	4,980	8.30	6,220
5.70	3,220	6.60	4,090	7.50	5,100		
5.80	3,310	6.70	4,190	7.60	5,220		

[a] Above gage height 13.0 feet this table is the same as the table for 1899 to 1901.
[b] Above gage height 8.3 feet this table is the same as that for 1903.

Estimated monthly discharge of Savannah River at Augusta.

[Drainage area, 7,294 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth inche
1899.[a]					
January	45,320	7,600	16,034	2.20	2
February	112,800	12,850	34,891	4.78	4
March	93,440	11,900	24,804	3.41	3
April	31,700	9,420	14,386	1.97	2
May	10,820	5,750	7,640	1.05	1
June	9,590	4,360	6,090	0.83	0
July	13,230	3,250	5,148	0.71	0
August	16,430	2,350	5,126	0.70	0
September	17,660	3,160	5,554	0.76	0
October	18,120	3,000	5,611	0.77	0
November	12,470	3,340	4,807	0.66	0
December	19,000	3,000	7,043	0.97	1
The year	112,800	2,350	11,428	1.57	21
1900.					
January	20,100	4,490	7,267	1.00	1
February	124,240	4,555	26,261	3.60	3
March	46,420	10,280	18,322	2.51	2
April	75,400	8,000	9,695	1.33	1
May	15,800	6,500	9,264	1.27	1
June	96,960	6,050	22,702	3.11	3
July	18,890	5,900	9,590	1.31	1
August	12,470	4,620	5,776	0.79	0
September	19,000	3,880	6,199	0.85	0
October	24,080	3,940	6,681	0.92	1
November	19,880	4,620	7,431	1.02	1
December	20,790	5,975	9,704	1.33	1
The year	124,240	3,880	11,574	1.59	21
1901.					
January	48,590	7,680	14,295	1.96	2
February	75,060	7,440	16,566	2.27	2
March	86,400	6,500	15,133	2.07	2
April	111,920	10,460	25,365	3.48	3
May	77,600	7,280	15,344	2.10	2
June	76,720	8,400	19,574	2.68	2
July	16,430	6,350	8,981	1.23	1
August	92,560	5,600	26,256	3.60	4
September	111,920	8,740	20,568	2.82	3
October	14,200	7,120	9,172	1.26	1
November	7,920	7,120	7,547	1.03	1
December	107,520	7,120	18,565	2.54	2
The year	111,920	5,600	16,447	2.25	30
1902.					
January	51,380	8,000	11,689	1.60	1
February	125,120	10,000	27,595	3.78	3
March	137,440	12,800	36,025	4.94	5
April	28,980	9,200	13,466	1.85	2
May	11,200	6,000	8,394	1.15	1
June	20,100	4,650	7,489	1.03	1
July	9,600	3,400	5,059	.69	
August	10,400	3,920	5,843	.80	
September	17,480	3,920	7,458	1.02	1
October	11,400	3,740	6,423	.88	1
November	14,540	3,920	5,851	.80	
December	37,310	6,800	12,700	1.74	2
The year	137,440	3,400	12,333	1.69	22

[a] Low-water daily estimates of flow are liable to considerable error from January to August and for December, 1899. See description, p. 39.

Estimated monthly discharge of Savannah River at Augusta—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
	18,120	7,600	10,591	1.45	1.67
y	130,400	8,800	39,580	5.42	5.64
	98,720	13,280	32,924	4.51	5.20
	49,520	11,000	19,907	2.73	3.05
	15,590	7,000	10,040	1.38	1.59
	64,400	8,200	18,265	2.50	2.79
	16,640	4,840	8,153	1.12	1.29
	26,550	4,650	9,054	1.24	1.43
er	13,490	3,920	5,315	.73	.81
	8,000	3,400	4,179	.57	.66
er	8,400	3,400	4,979	.68	.76
r	5,600	3,740	4,405	.60	.69
e year	130,400	3,400	13,949	1.91	25.58
1904.					
	14,860	3,880	5,583	.765	.882
y	28,170	4,560	9,206	1.26	1.36
	21,830	5,430	8,579	1.18	1.36
	8,470	4,680	5,512	.756	.844
	6,550	2,690	4,292	.588	.678
	10,410	2,360	4,088	.560	.625
	8,470	2,060	3,769	.517	.596
	55,750	3,880	11,710	1.61	1.86
er	10,230	2,440	3,796	.520	.580
	2,690	a 1,450	2,079	.285	.329
er	4,100	2,000	3,015	.413	.461
r	10,980	2,780	4,772	.654	.754
e year	55,750	1,450	5,533	.759	10.33
1905.					
	25,800	4,300	7,075	.970	1.12
y	62,640	4,520	18,780	2.57	2.68
	14,330	5,100	7,275	.997	1.15
	8,000	4,410	5,416	.743	.829
	27,580	4,090	9,764	1.34	1.54
	5,890	3,690	4,704	.645	.720
	43,880	4,860	12,620	1.73	1.99
	17,480	3,890	7,745	1.06	1.22
er	8,600	2,800	4,218	.578	.645
	9,200	2,650	3,916	.537	.619
er	5,220	2,960	3,789	.519	.579
r	82,880	3,590	19,270	2.64	3.04
e year	82,880	2,650	8,714	1.19	16.13

low days in October, 1904, occurred on Sundays, when the mills were not running, and water g held back by the dam.

CHAUGA RIVER NEAR MADISON, S. C.

station was established on Chauga River at Bryan wagon e, 2 miles east of Madison and 1 mile above the mouth of the by M. R. Hall, and measurements were made during 1900 and in connection with the old station on Tugaloo River at Cooks , near Madison. When the Tugaloo River station was reestab- in 1903 the Chauga River station was also reestablished for the se of making a series of miscellaneous measurements.

e channel is straight for about 500 feet above the station; below curved for about 50 feet and then straight. The current is

The right bank is high, clean, and liable to overflow during ts. The left bank is high, rocky, wooded, and not subject to

overflow. Floods can not be measured, as high water goes over the bridge.

Discharge measurements are made from the upstream side of the single-span wooden bridge, which is supported by log cribs filled with rock and anchored to bed rock. The initial point for soundings is the top of the anchor bolt in the upstream corner of the right-bank abutment.

Gage heights are determined directly from the bench marks. No. 1 is the top of the downstream guard rail 7 feet from the right bank; elevation, 10.00 feet. No. 2 is a large nail driven horizontally into the center of the downstream end of the lowest cross log of the right-bank crib abutment; elevation, 4.50 feet. Elevations refer to the datum of the assumed gage.

Discharge measurements of Chauga River near Madison, S. C.

Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*
June 10	0.91	9
September 5	1.20	16
October 27	.44	6
1905.		
May 1	1.23	13
June 29	.97	10

SENECA RIVER NEAR CLEMSON COLLEGE, S. C.

This station was established as a regular station by M. R. Hall on December 8, 1903, at which time a standard chain gage and the bench marks were established. A vertical gage had been put in July 19, 1903, and records obtained from it for a portion of the time. Both gages are referred to the same datum. The station is located at the highway bridge about 3 miles south of Clemson College, S. C., and about 300 feet up the river from the crossing of the Blue Ridge Railroad.

At ordinary stages the channel is about 150 feet wide. The right bank is high and will not overflow, but the left bank will overflow for a considerable width at a gage height of about 23 feet. The bed of the river is sandy. The current is moderate. At low stages there is a daily fluctuation of about 1 foot in the gage heights, caused by the operations of water powers above.

The standard chain gage is located on the lower chord on the downstream side of the bridge; length of chain, 31.82 feet. The vertical gage is in 5-foot sections, fastened to the iron braces between the cylinders of the right-bank pier. Mud accumulates at the lower end of the vertical gage. The gage is read twice each day by M. L. Sanders. Bench marks were established as follows: (1) The top of the upstream cylinder of the right-bank pier at a point marked "B. M." by

isel cuts; elevation, 28.95 feet. (2) A copper plug set in rock on e right bank under the railroad bridge, and about 20 feet to the ght of the center pier; elevation, 10.27 feet.

Discharge measurements of Seneca River near Clemson College, S. C.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
y 10	4.54	1,388	June 9	3.73	1,015
y 28	3.53	959	July 16	1.41	286
y 29	3.56	1,077	August 25	2.36	509
gust 27	3.14	869	September 6	3.40	924
ptember 23	2.51	616	October 5	2.15	520
tober 9	3.43	1,050	December 6	6.35	2,274
cember 8	2.21	539	December 6	5.52	1,901
1904.			1905.		
nuary 14	2.23	601	March 8	3.75	1,093
nuary 14	2.87	802	March 20	3.60	1,023
nuary 28	3.41	1,027	May 1	3.43	890
rch 10	5.28	1,680	June 1	4.06	1,204
rch 11	4.76	1,493	September 7	3.59	996
y 11	3.43	978	October 14	3.69	1,000
ne 9	3.55	920			

Daily gage height, in feet, of Seneca River near Clemson College, S. C.

Day.	Nov.	Dec.	Day	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1903.			1903.			1903.			1903.		
	2.8	2.4	9	3.1	2.4	17	2.9	2.8	25	2.5	3.1
	2.8	2.5	10	2.8	2.35	18	3.8	2.45	26	2.6	3.0
	3.5	2.5	11	2.8	2.7	19	3.1	2.3	27	2.6	2.3
	4.9	2.7	12	2.7	2.45	20	3.0	2.2	28	2.6	3.1
	5.7	2.7	13	2.8	2.5	21	3.0	2.3	29	2.5	2.6
	4.7	2.65	14	2.6	2.8	22	2.8	2.9	30	2.6	2.6
	3.0	2.5	15	2.8	2.65	23	3.0	2.8	31		2.45
	3.0	2.4	16	2.8	2.6	24	2.8	2.8			

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
	2.55	2.85	3.2	3.8	3.1	6.4	2.95	4.45	2.7	2.4	1.9	2.2
	2.65	2.75	3.55	3.8	3.15	4.0	2.5	3.95	3.15	2.25	1.95	2.15
	2.5	2.85	3.4	3.1	3.45	3.3	2.4	3.25	2.8	2.25	1.9	2.25
	2.75	2.85	3.3	3.5	3.35	3.2	2.1	2.65	2.55	2.0	3.05	2.05
	2.3	2.8	3.45	3.4	3.6	2.85	1.75	3.15	3.2	1.95	2.7	2.9
	2.3	2.6	3.05	3.5	3.25	3.2	2.3	4.45	3.1	1.95	2.55	6.05
	2.6	2.7	11.7	4.75	3.05	4.2	2.3	7.0	2.7	1.85	2.55	3.75
	2.7	4.45	8.0	5.25	3.65	4.8	2.0	9.0	2.7	1.5	2.0	3.4
	2.55	3.9	6.0	5.25	6.2	3.6	2.5	5.1	2.8	1.8	1.95	3.55
	2.45	3.7	5.1	4.15	4.35	3.1	2.5	4.0	2.7	1.8	2.15	2.7
	2.75	3.65	4.8	4.25	4.15	3.4	2.45	5.5	2.8	1.95	2.05	2.8
	2.5	3.25	4.55	3.95	3.45	2.75	2.4	6.0	2.65	2.4	2.45	2.65
	2.5	3.25	4.15	3.95	3.4	2.7	2.4	4.6	2.75	1.8	2.6	2.45
	2.5	3.1	4.25	3.7	3.35	2.7	2.4	3.7	2.75	2.3	2.7	2.4
	2.5	2.75	4.05	3.75	3.2	2.5	2.1	3.15	2.45	2.25	2.9	2.4
	2.5	2.95	3.9	4.1	3.2	2.7	2.05	5.35	2.45	1.35	2.6	2.3
	2.6	2.7	3.75	3.75	3.0	2.6	2.45	3.7	2.5	1.45	2.25	2.5
	2.75	2.75	3.75	3.5	3.2	2.5	2.4	3.6	2.35	1.75	2.2	2.5
	2.5	3.25	3.7	3.45	3.0	2.3	2.55	2.85	2.45	1.25	2.6	2.45
	2.5	5.7	3.3	3.45	3.0	3.55	1.85	4.4	2.05	1.3	2.15	2.3
	2.45	4.45	3.6	3.45	3.1	3.0	2.0	3.1	2.45	1.4	2.25	2.3
	3.05	10.15	4.8	3.4	2.5	2.5	2.45	2.5	2.9	1.7	2.25	2.3
	6.9	6.45	5.7	3.5	2.95	2.5	2.55	2.9	3.0	1.4	2.8	2.15
	4.35	5.15	6.5	3.5	2.75	2.45	2.0	2.85	2.9	1.6	2.6	1.95
	3.85	4.35	5.3	3.2	2.5	2.2	2.6	3.2	2.35	1.7	2.65	2.15

Daily gage height, in feet, of Seneca River near Clemson College, S. C.—Continu

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1904.											
26	3.25	3.75	4.2	3.3	2.5	2.0	2.7	3.1	2.4	1.8	2.6
27	3.1	4.05	4.7	3.6	2.5	2.05	2.1	4.3	2.25	1.75	2.05
28	3.0	4.0	4.4	3.1	2.4	2.45	2.3	4.75	3.45	1.8	2.05
29	3.1	3.55	4.3	3.2	2.55	3.1	2.45	3.1	2.95	1.7	2.05
30	3.05	.....	4.1	3.5	3.1	4.1	2.4	3.15	2.9	1.45	2.05
31	2.85	.....	3.9	.....	7.0	.....	2.45	3.0	.....	1.75	.....
1905.											
1	2.6	2.95	4.7	3.1	3.4	3.6	16.5	3.4	3.4	2.25	3.0
2	2.55	3.1	4.3	3.2	3.4	3.6	12.7	3.0	4.1	2.3	2.95
3	2.7	2.95	4.4	3.1	4.3	3.4	5.6	3.0	3.6	3.3	2.85
4	2.65	3.1	4.1	3.0	6.6	3.4	4.6	3.1	4.2	3.8	2.75
5	3.0	3.3	4.1	3.4	6.0	3.2	6.4	4.4	4.3	3.0	2.75
6	2.45	3.5	4.2	3.6	5.6	3.2	6.4	3.6	4.2	2.65	2.75
7	5.0	4.2	4.1	3.6	7.4	3.2	5.5	3.8	3.4	2.65	2.65
8	3.5	5.1	3.4	3.6	5.2	3.2	4.8	3.5	3.3	2.7	2.6
9	3.3	8.8	4.0	3.4	5.2	2.95	4.2	6.4	3.4	2.4	2.6
10	3.1	7.5	4.2	2.9	4.0	3.0	4.5	4.2	3.2	2.6	2.5
11	2.8	6.0	4.4	3.0	3.1	3.2	8.2	11.0	3.3	11.1	2.6
12	12.2	6.3	4.2	2.8	2.9	3.1	16.2	8.6	3.1	7.0	2.7
13	12.0	10.3	4.5	3.2	2.8	3.1	13.9	6.9	3.4	4.4	2.75
14	6.5	7.2	3.8	2.85	3.4	3.0	13.5	5.4	3.5	2.6	2.75
15	4.6	5.4	3.8	3.1	3.4	3.0	8.6	6.0	3.2	2.95	2.45
16	4.2	4.5	3.8	3.2	3.9	2.0	6.0	6.2	2.85	3.1	2.5
17	4.3	4.7	3.8	3.2	3.0	3.2	5.3	5.9	3.4	3.1	2.5
18	4.2	4.3	3.8	2.8	3.1	3.6	5.1	5.2	3.2	3.0	2.55
19	3.9	4.0	3.6	2.85	3.4	3.4	3.5	5.1	3.4	3.0	2.75
20	4.2	6.2	3.6	3.0	3.4	3.7	3.1	4.6	3.0	2.75	3.6
21	4.0	11.2	3.6	2.85	3.4	4.4	3.3	4.6	3.0	2.75	3.0
22	4.1	8.0	3.7	2.95	4.5	4.6	4.2	4.5	2.85	2.95	2.95
23	3.5	6.1	3.7	2.7	5.4	4.0	4.2	4.6	3.2	2.95	2.95
24	3.5	5.4	3.1	2.8	6.4	3.6	4.2	4.2	3.6	2.95	2.65
25	3.5	5.2	3.2	2.75	4.2	3.2	4.2	6.5	3.2	2.95	2.75
26	2.95	5.0	3.3	3.2	4.6	3.0	4.0	7.1	3.0	3.2	2.45
27	3.1	4.6	3.5	2.7	5.4	2.8	4.3	4.6	3.1	3.2	3.0
28	2.75	4.2	3.5	3.0	4.2	2.85	3.6	4.1	2.9	3.2	2.75
29	2.55	.....	3.2	2.95	4.6	2.9	4.2	3.8	2.4	2.9	2.35
30	3.1	.....	3.1	3.6	4.8	4.0	3.7	3.8	2.45	2.95	2.35
31	3.0	.....	3.0	.....	4.2	.....	4.0	3.4	.....	2.95	.....

Rating tables for Seneca River near Clemson College, S. C.

NOVEMBER 1 TO DECEMBER 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.2	550	3.1	860	4.0	1,180	4.9	1,530
2.3	584	3.2	895	4.1	1,218	5.0	1,570
2.4	618	3.3	930	4.2	1,256	5.1	1,610
2.5	652	3.4	965	4.3	1,294	5.2	1,650
2.6	686	3.5	1,000	4.4	1,332	5.3	1,690
2.7	720	3.6	1,036	4.5	1,370	5.4	1,730
2.8	755	3.7	1,072	4.6	1,410	5.5	1,770
2.9	790	3.8	1,108	4.7	1,450	5.6	1,810
3.0	825	3.9	1,144	4.8	1,490	5.7	1,850

JANUARY 1, 1904, TO DECEMBER 31, 1905.

1.40	285	2.60	644	3.80	1,096	5.00	1,620
1.50	310	2.70	678	3.90	1,138	5.20	1,720
1.60	336	2.80	713	4.00	1,180	5.40	1,820
1.70	363	2.90	749	4.10	1,222	5.60	1,920
1.80	391	3.00	785	4.20	1,265	5.80	2,020
1.90	420	3.10	822	4.30	1,308	6.00	2,120
2.00	450	3.20	859	4.40	1,351	6.20	2,230
2.10	481	3.30	897	4.50	1,395	6.40	2,340
2.20	512	3.40	936	4.60	1,440	6.60	2,450
2.30	544	3.50	975	4.70	1,485	6.80	2,560
2.40	577	3.60	1,015	4.80	1,530	7.00	2,670
2.50	610	3.70	1,055	4.90	1,575	(a)	

a Discharge estimated above gage height 7 feet.

Estimated monthly discharge of Seneca River near Clemson College, S. C.

[Drainage area, 646 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
r	1,850	652	861	1.33	1.48
r	860	550	685	1.06	1.22
1904.					
	2,615	544	769	1.19	1.37
	4,700	644	1,162	1.80	1.94
	5,800	804	1,506	2.33	2.69
	1,745	822	1,078	1.67	1.86
	2,670	577	943	1.46	1.68
	2,340	450	841	1.30	1.45
	767	377	557	.862	.994
	3,920	610	1,253	1.94	2.24
er	956	466	683	1.06	1.18
	577	250	377	.584	.673
er	804	420	564	.873	.974
r	2,148	435	741	1.15	1.33
e year	5,800	250	873	1.35	18.38
1905.					
	5,530	594	1,287	1.99	2.29
	4,980	767	1,926	2.98	3.10
	1,485	785	1,100	1.70	1.96
	1,015	678	817	1.26	1.41
	2,890	713	1,370	2.12	2.44
	1,440	713	921	1.43	1.60
	7,895	822	2,433	3.77	4.35
er	4,870	785	1,675	2.59	2.99
	1,308	577	905	1.40	1.56
er	4,925	528	967	1.50	1.73
r	1,015	561	688	1.07	1.19
	7,620	644	2,199	3.40	3.92
e year	7,805	528	1,357	2.10	28.54

ROCKY RIVER NEAR CALHOUN FALLS, S. C.

s station was established as a bench-mark station. It is located ighway bridge just below Swearingen's mill, about 3½ miles west of Calhoun Falls, S. C. Discharge measurements are made the downstream side of the bridge, which is 110 feet long and rted by two timber piers. The initial point for soundings is the end of the downstream guard rail. The channel is curved for 200 feet above and straight for 300 feet below the station. The it is swift. Both banks are subject to overflow during high . The bed of the stream is composed of sand and gravel and is hangeable. The washing out and filling in of the channel pre- rating. The bench mark is the top of the downstream end of cap on the left side of pier next the right bank. Its elevation) feet above gage datum.

Discharge measurements of Rocky River near Calhoun Falls, S. C.

Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*
March 17	1.60	23
September 7	2.50	18

BROAD RIVER (OF GEORGIA) NEAR CARLTON.

This station was established May 27, 1897, by M. R. Hall. The gage is now maintained and the observer paid by the United States Weather Bureau. The station is located at the Seaboard Air Line bridge 3 miles east of Carlton and 2 miles above the mouth of the South Fork.

The channel above and below the station is straight for 500 feet. The right bank is high and is not liable to overflow. The left bank is low for about 400 feet, beyond which it is high and rocky. It overflows at a gage height of about 16 feet. The bed of the stream is sand and gravel and is somewhat changeable.

Discharge measurements are made from the upstream side of the deck bridge, which has two spans of 125 feet each, with trestle approaches 340 feet long on the left bank and 50 feet long on the right bank. The initial point for soundings is the end of the iron bridge on the right bank, upstream side.

A standard chain gage is fastened to the guard rail, with its bottom resting on the upstream end of the cross-ties. The center of the pulley is 39.5 feet from the initial point for soundings. The length of the chain is 54.00 feet. The gage is read once each day by S. P. Powers, jr. During the low water of October 1 to December 31, 1905, the gage was read twice each day. Bench marks were established as follows: (1) The top of the upstream iron girder under the cross-ties at a point about 40 feet from the initial point for soundings; elevation, 51 feet. (2) The top of the capstone of the right bank pier at a point under the upstream side of the end of the bridge; elevation, 30.78 feet above the datum of the gage, which is 384 feet above sea level.

Discharge measurements of Broad River (of Georgia) near Carlton.

Date.	Gage. height.	Dis- charge.	Date.	Gage. height.	Dis- charge.
1897.	*Feet.*	*Sec.-ft.*	1901.	*Feet.*	*Sec.-ft.*
27	2.10	5.96	January 1	3.55	1,497
22	1.92	5.80	January 22	2.85	991
28	2.24	9.20	April 23	3.50	1,807
ist 17	2.25	865	August 14	5.25	3,173
mber 27	1.60	358	1902.		
ber 29	1.67	407	July 18	2.40	638
mber 10	1.70	395	September 30	2.83	960
nber 10	2.00	615	1903.		
1898.			March 21	4.55	2,592
ary 29	2.68	995	May 8	3.10	1,242
ary 21	2.00	577	June 11	3.65	1,766
20	2.10	667	August 14	2.70	953
14	1.56	366	September 16	4.52	2,435
15	3.75	2,165	October 29	2.16	606
mber 13	2.50	930	December 8	2.20	628
o	2.50	960	1904.		
er 8	3.05	1,446	March 17	2.62	809
1899.			May 5	2.20	581
ary 28	9.05	8,281	July 21	1.48	299
h 1	5.28	3,205	September 6	2.37	737
25	3.65	1,841	November 15	1.88	460
15	2.60	919	1905.		
28	2.80	1,063	January 18	2.50	745
mber 27	2.00	514	Do	2.50	762
mber 11	2.05	485	March 18	2.25	642
nber 21	2.25	591			
1900.					
ary 16	4.25	2,088			
h 30	3.30	1,480			
3	4.49	2,562			
ber 17	2.22	661			

Daily gage height, in feet, of Broad River (of Georgia) near Carlton.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
897.							1897.						
.....	1.85	1.85	1.7	1.5	1.65	2.2	17	1.85	3.3	1.5	1.6	1.7	2.0
.....	1.85	1.85	2.0	1.5	2.4	2.1	18	3.6	2.0	1.5	1.8	1.7	2.0
.....	1.8	1.8	2.3	1.5	2.25	2.2	19	4.9	1.9	1.5	2.0	1.65	2.05
.....	1.8	1.8	1.85	1.5	1.95	2.7	20	6.3	2.0	1.5	2.4	1.65	2.1
.....	2.0	1.8	1.8	1.5	1.8	2.55	21	5.3	1.95	1.5	2.2	1.7	2.1
.....	2.0	1.75	1.7	1.5	1.8	2.5	22	3.85	2.15	1.5	2.1	1.7	2.15
.....	1.9	2.6	1.6	1.5	1.8	2.3	23	2.9	2.0	1.7	1.8	1.7	2.4
.....	2.1	2.2	1.55	1.5	1.75	2.1	24	2.3	1.95	1.7	1.8	1.7	2.2
.....	2.35	2.0	1.55	1.5	1.75	2.05	25	2.15	1.85	1.65	1.7	1.7	2.1
.....	2.05	2.0	1.55	1.5	1.7	2.0	26	2.25	1.8	1.65	1.65	1.7	2.3
.....	2.55	1.95	1.55	1.6	1.7	1.95	27	2.15	1.75	1.6	1.7	3.15	2.65
.....	2.35	1.9	1.55	2.45	1.7	1.95	28	2.3	1.75	1.6	1.65	2.75	2.3
.....	1.95	1.85	1.5	2.5	1.7	1.9	29	2.1	1.7	1.55	1.65	2.3	2.15
.....	1.85	1.8	1.5	2.05	1.7	2.1	30	1.95	1.7	1.5	1.65	2.7	2.1
.....	1.8	1.8	1.5	1.85	1.7	2.3	31	1.9	1.65	.....	1.65	.....	2.1
.....	1.75	4.55	1.5	1.7	1.7	2.1							

Daily gage height, in feet, of Broad River (of Georgia) near Carlton—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
1	2.05	2.25	1.9	3.6	2.2	1.6	1.4	2.1	9.1	2.15	2.35	2.75
2	2.0	2.15	1.9	2.75	2.15	1.6	1.35	1.95	18.85	2.1	2.35	2.8
3	1.95	2.1	1.95	2.45	2.05	1.6	1.35	1.8	18.53	3.2	2.3	2.8
4	1.95	2.05	2.1	2.3	2.05	1.6	1.4	3.0	13.38	4.85	2.3	3.9
5	1.95	2.0	2.15	5.25	2.0	1.55	1.8	3.85	7.88	11.2	2.3	3.5
6	1.95	2.05	2.05	4.45	2.0	1.5	2.85	4.0	5.0	10.1	3.2	3.1
7	1.95	2.05	2.0	3.0	2.0	1.45	3.5	4.2	4.6	4.35	2.4	2.6
8	1.95	2.0	1.95	2.6	1.95	1.45	2.6	3.4	4.5	3.25	2.35	2.7
9	1.95	2.0	1.9	2.45	1.95	1.4	2.3	2.5	3.5	2.9	2.35	2.6
10	1.9	2.0	1.9	2.4	1.9	1.35	1.95	2.2	2.9	2.7	2.65	2.5
11	1.9	2.0	1.85	2.45	1.9	1.35	1.7	3.05	2.85	2.6	2.45	2.5
12	1.9	2.0	1.85	2.35	1.9	1.4	1.6	6.2	2.7	2.5	2.4	2.5
13	1.9	1.95	1.85	2.25	1.85	2.0	1.9	4.05	2.55	2.45	2.45	2.5
14	1.9	1.95	2.35	2.3	1.85	1.6	4.2	3.5	2.45	2.4	2.95	2.6
15	1.9	1.95	2.8	2.3	1.85	1.5	3.85	3.0	2.4	2.3	2.9	2.4
16	1.9	1.9	2.4	2.25	1.8	1.5	3.55	2.7	2.35	2.25	2.75	2.4
17	1.85	1.9	2.45	2.15	1.8	1.5	2.55	2.35	2.35	2.25	3.0	2.6
18	1.85	1.95	2.35	2.1	1.8	2.4	2.0	3.25	2.25	2.7	3.0	2.6
19	1.85	2.05	2.25	2.05	1.85	2.35	1.8	6.95	2.25	3.35	3.55	2.6
20	2.15	2.0	2.1	2.1	2.1	2.15	1.8	3.6	2.2	2.65	3.4	2.7
21	2.55	2.0	2.05	2.05	1.85	1.8	1.7	3.0	2.2	3.6	2.9	3.0
22	2.35	1.95	2.0	2.0	1.8	1.6	1.65	2.85	2.25	4.45	2.7	3.6
23	2.2	1.95	1.95	2.0	1.8	1.55	9.0	2.55	2.4	3.65	2.7	4.6
24	2.9	1.9	1.95	2.95	1.95	1.55	6.0	2.25	3.45	3.0	2.6	4.6
25	4.9	1.9	1.9	2.75	2.1	1.5	4.2	2.1	2.55	2.65	2.55	3.6
26	5.1	1.85	1.9	2.3	1.8	1.5	3.1	2.45	2.35	2.55	2.5	3.1
27	3.3	1.9	1.9	2.6	1.75	2.3	2.6	2.6	2.25	2.45	2.45	2.8
28	3.05	1.95	1.85	3.3	1.65	1.55	6.4	3.0	2.2	2.4	2.4	2.7
29	2.7	.....	1.95	2.6	1.6	1.5	4.6	2.7	2.2	2.4	2.75	2.65
30	2.5	.....	3.35	2.35	1.6	1.45	2.7	2.5	2.15	2.45	3.0	2.6
31	2.35	.....	4.4	.....	1.6	.....	2.35	2.35	.....	2.4	.....	2.6
1899.												
1	3.1	3.45	5.2	5.8	3.0	2.6	2.3	2.4	3.8	1.9	2.15	2.35
2	2.95	3.0	4.1	4.45	3.0	2.55	2.25	2.35	3.0	1.9	2.1	2.4
3	2.75	3.75	3.8	3.6	2.95	2.5	2.2	2.25	2.5	1.9	2.1	2.3
4	2.7	3.7	3.6	3.45	2.95	2.5	2.2	2.2	2.3	1.9	2.05	2.3
5	2.65	4.3	3.95	3.7	3.0	2.45	2.2	2.2	2.2	2.0	2.05	2.25
6	4.45	7.2	4.2	3.45	3.2	2.4	2.2	2.15	2.15	2.2	2.05	2.2
7	6.45	13.18	3.65	3.6	3.15	2.4	2.25	2.1	2.1	2.15	2.05	2.2
8	6.4	10.6	3.45	4.4	3.0	2.5	2.4	2.1	2.1	4.3	2.05	2.2
9	3.9	5.45	3.4	4.2	2.95	2.6	2.3	2.1	2.1	3.4	2.05	2.2
10	3.3	4.3	3.35	3.6	2.95	2.45	2.4	2.1	2.1	2.5	2.05	2.2
11	3.8	3.75	3.3	3.5	2.9	2.4	2.3	2.15	2.5	2.35	2.05	2.2
12	4.05	3.6	3.3	3.4	2.85	2.6	2.25	2.1	2.1	2.25	2.05	3.4
13	3.7	3.45	3.25	3.3	2.8	3.7	2.2	2.15	2.5	2.2	2.05	3.6
14	3.45	3.35	3.5	3.3	2.8	3.0	2.2	2.05	2.0	2.15	2.05	2.95
15	3.75	3.3	4.4	3.25	2.75	2.4	2.15	2.0	2.0	2.1	2.1	2.5
16	3.5	4.4	13.88	3.25	2.75	2.5	2.1	1.95	1.95	2.1	2.1	2.45
17	3.5	5.05	11.3	3.2	2.7	2.65	2.1	1.9	1.95	2.1	2.05	2.35
18	3.25	4.45	4.7	3.15	2.7	2.65	2.25	1.9	1.95	2.1	2.05	2.3
19	3.1	3.8	4.5	3.25	2.65	2.55	2.15	1.9	1.95	2.1	2.05	2.3
20	3.0	3.5	8.1	3.2	2.65	2.45	2.1	1.9	2.05	2.1	2.05	2.3
21	2.9	3.55	5.2	3.15	2.6	2.4	2.1	2.0	2.0	2.1	2.05	2.25
22	2.85	3.6	4.0	3.1	2.65	2.35	2.05	1.95	2.0	2.05	2.05	2.25
23	2.95	3.5	4.15	3.05	2.7	2.3	2.2	2.0	2.0	2.05	3.65	2.2
24	3.05	3.3	4.55	3.1	2.65	2.3	2.25	1.95	1.95	2.05	3.45	4.4
25	3.0	3.2	3.75	3.2	2.6	2.3	2.15	2.0	1.95	2.05	2.45	4.3
26	2.95	3.15	3.6	3.5	2.6	3.7	2.45	2.05	1.95	2.05	3.6	3.0
27	2.85	15.78	3.5	3.2	2.6	3.0	6.5	3.95	2.0	2.05	3.7	2.6
28	2.8	11.15	3.45	3.15	2.55	2.8	5.3	2.45	1.95	2.05	2.9	2.6
29	2.8	.....	4.2	3.1	2.55	2.8	3.5	2.1	1.95	2.05	2.55	2.6
30	2.75	.....	3.7	3.1	2.5	2.5	2.8	3.5	1.9	2.1	2.4	2.5
31	3.1	.....	5.0	.....	2.7	.....	2.5	4.1	.....	2.15	.....	2.45
1900.												
1	2.4	2.3	5.5	3.1	3.4	2.6	3.5	3.7	2.3	2.1	2.4	2.4
2	2.4	2.3	4.9	3.1	3.2	2.5	3.3	3.8	2.5	2.1	2.4	2.4
3	2.4	2.3	3.85	3.0	4.7	2.8	3.4	3.6	2.5	2.1	6.5	2.4
4	2.35	2.3	3.3	3.1	3.9	2.9	3.2	3.6	2.3	2.2	3.5	4.2
5	2.35	3.3	3.15	3.0	3.2	2.9	3.0	2.5	2.2	2.3	2.8	5.0

Daily gage height, in feet, of Broad River (of Georgia) near Carlton—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
6	2.3	2.95	3.0	3.0	3.1	3.0	2.9	2.5	2.2	2.5	2.6	3.8
7	2.3	2.7	3.0	2.9	3.0	4.3	2.8	2.5	2.1	3.0	2.5	3.2
8	2.3	2.65	6.5	2.8	3.0	7.7	2.8	2.4	2.1	2.6	2.4	2.8
9	2.3	2.8	6.8	2.8	2.9	7.6	2.8	2.4	2.1	2.5	2.4	2.7
10	2.4	4.0	5.1	2.7	2.9	3.8	2.7	2.3	2.1	2.4	2.4	2.6
11	2.9	6.0	3.8	3.5	2.9	3.2	2.6	2.3	2.1	2.3	2.4	2.6
12	5.85	10.5	3.3	3.9	2.8	3.1	2.9	2.3	2.0	2.3	2.4	2.5
13	4.9	22.2	3.2	3.9	2.8	3.1	3.05	4.0	2.0	2.7	2.3	2.5
14	3.3	16.9	3.1	3.3	2.8	3.8	3.55	2.5	2.1	2.6	2.3	2.8
15	2.95	8.0	3.0	3.1	2.7	3.1	3.0	2.4	5.5	2.4	2.3	2.6
16	2.75	4.3	4.2	3.0	2.7	3.5	2.9	2.4	5.0	2.3	2.3	2.5
17	2.65	3.7	3.8	2.9	2.7	4.3	2.8	2.5	4.0	2.2	2.3	2.4
18	3.15	3.3	3.3	3.9	2.7	5.6	2.7	2.5	2.8	2.2	2.3	2.4
19	3.6	3.2	3.1	7.5	3.0	4.9	2.6	2.6	2.5	2.2	2.4	2.4
20	3.75	3.1	4.6	6.7	2.9	3.5	2.6	2.4	2.4	2.2	2.4	2.8
21	3.7	3.1	4.1	8.0	2.7	3.1	2.5	2.3	2.3	2.2	2.4	3.8
22	2.85	3.8	3.7	12.2	2.7	3.0	2.5	2.2	2.3	2.1	2.5	3.3
23	2.7	3.65	3.4	5.8	2.7	4.2	2.5	2.3	2.3	4.2	2.4	3.0
24	2.6	3.2	3.6	6.5	4.0	13.0	3.0	2.2	2.3	5.0	2.4	2.9
25	2.5	3.65	4.7	7.3	3.2	12.6	2.7	2.2	2.2	3.1	3.6	2.8
26	2.45	3.6	6.5	5.1	2.9	7.0	2.9	2.6	2.2	4.0	3.6	2.6
27	2.45	3.2	5.3	3.9	2.8	5.6	3.4	2.5	2.2	3.8	2.8	2.5
28	2.4	3.0	4.0	3.7	2.7	4.6	3.7	2.2	2.2	3.1	2.6	2.5
29	2.4	.....	3.5	3.5	2.7	4.0	3.4	2.2	2.2	2.7	2.5	2.5
30	2.35	.....	3.3	3.5	2.6	4.5	3.3	2.9	2.1	2.5	2.5	2.5
31	2.3	.....	3.25	.....	2.6	.....	3.9	2.2	.....	2.5	.....	3.8
1901.												
1	3.6	3.2	2.6	3.6	2.7	4.3	3.9	2.4	5.0	2.9	2.5	2.5
2	3.2	2.9	2.6	6.9	2.6	3.9	3.1	2.3	3.9	2.9	2.5	2.5
3	3.6	3.8	2.6	11.95	2.6	3.3	3.0	2.3	3.5	4.8	2.5	3.0
4	3.5	7.9	2.6	9.3	2.6	3.0	2.9	2.3	3.1	2.9	2.5	3.4
5	3.3	6.8	2.6	4.5	2.5	2.9	2.8	2.3	3.0	2.8	2.6	3.4
6	2.8	4.1	2.6	3.9	2.9	2.8	2.7	2.5	2.9	2.7	2.5	2.7
7	2.7	3.5	2.6	3.6	2.9	3.7	2.7	4.4	2.9	2.7	2.5	2.7
8	2.7	3.3	2.5	3.4	2.8	3.0	2.7	4.0	2.8	2.6	2.5	2.6
9	2.6	4.2	2.5	3.3	2.8	2.8	2.6	3.0	2.8	2.6	2.5	2.6
10	2.6	4.8	2.5	3.2	2.7	2.7	2.6	2.6	2.7	2.6	2.5	2.9
11	5.9	3.8	4.4	3.1	2.7	2.7	2.5	4.3	2.7	2.5	2.5	2.8
12	11.4	3.5	4.1	3.1	2.7	3.1	2.5	3.2	3.0	2.5	2.5	2.7
13	11.5	3.2	3.2	3.1	2.7	2.9	2.4	2.8	2.8	3.0	2.6	2.6
14	5.0	3.1	3.0	5.5	2.6	4.6	2.4	5.5	2.7	3.0	2.6	2.7
15	4.1	3.0	2.9	4.9	2.6	11.1	2.6	6.0	2.7	2.8	2.5	5.3
16	3.4	2.9	2.8	3.9	2.6	11.2	2.6	10.0	2.75	2.7	2.5	4.2
17	3.4	2.9	2.7	3.5	2.6	5.0	4.6	8.4	6.6	2.7	2.5	3.1
18	3.0	2.9	2.7	3.4	3.0	3.9	3.2	5.4	14.8	2.6	2.5	2.9
19	3.0	2.8	2.6	3.6	3.5	3.6	4.6	3.9	8.6	2.6	2.6	2.8
20	2.9	2.8	2.6	4.4	5.7	3.3	6.3	4.3	4.6	2.6	2.6	2.7
21	2.8	2.7	3.0	4.3	5.7	3.2	3.5	6.7	3.6	2.6	2.7	2.7
22	2.8	2.7	2.9	4.0	7.9	3.2	2.8	5.4	3.3	2.6	2.6	2.6
23	2.8	2.7	2.8	3.5	7.7	3.8	2.7	7.3	3.1	2.5	2.6	2.6
24	2.9	2.8	2.8	3.3	4.0	3.6	2.6	9.0	3.0	2.5	2.6	3.1
25	3.6	2.8	2.8	3.2	3.4	4.8	2.5	5.1	2.9	2.5	2.6	3.0
26	3.1	2.7	14.25	3.2	3.5	4.0	2.5	4.3	2.9	2.5	2.6	3.0
27	2.9	2.7	13.35	3.2	3.3	3.8	3.2	5.5	2.8	2.5	2.5	3.0
28	2.9	2.7	8.4	3.2	3.1	3.7	2.8	8.4	2.9	2.5	2.5	4.0
29	2.8	.....	4.2	3.0	3.0	3.6	2.6	6.3	3.0	2.5	2.5	14.2
30	2.8	.....	3.6	2.8	2.9	5.9	2.6	6.5	2.9	2.5	2.5	19.9
31	3.5	.....	3.6	.....	2.8	.....	2.5	4.9	.....	2.5	.....	12.4
1902.												
1	4.7	7.5	23.2	4.3	3.3	2.9	2.2	2.3	2.3	3.9	2.3	4.3
2	4.0	23.2	9.5	4.0	3.4	2.8	2.2	2.2	2.2	3.6	2.2	3.6
3	3.7	17.1	5.8	3.8	3.3	2.7	2.3	3.1	2.2	2.7	2.2	6.6
4	3.5	6.3	4.8	3.8	3.3	2.7	2.8	3.0	2.2	2.6	2.1	6.4
5	3.4	5.7	4.4	3.7	3.2	2.6	2.6	2.7	2.2	3.6	2.2	4.5
6	3.3	4.1	4.2	3.7	3.7	2.6	2.3	2.5	2.2	3.0	2.5	4.0
7	3.2	3.8	3.9	3.7	3.3	2.6	2.2	2.3	2.1	2.65	2.5	3.3
8	3.1	3.5	3.8	3.6	3.2	2.8	2.4	2.2	2.1	2.45	2.3	3.0
9	3.1	3.4	4.0	3.5	3.2	2.6	2.8	2.1	3.3	2.4	2.3	2.9
10	3.0	3.4	3.9	3.4	3.1	2.5	2.4	2.1	4.7	2.3	2.3	2.7

Daily gage height, in feet, of Broad River (of Georgia) near Carlton—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1902.												
11	3.0	3.3	3.8	3.4	3.1	2.5	2.4	2.1	3.6	2.5	2.3	2.7
12	2.9	3.3	3.7	3.3	3.1	2.5	2.7	2.6	2.6	3.5	2.3	2.6
13	2.9	3.3	4.6	3.3	3.0	2.5	2.6	2.3	2.8	2.9	2.2	2.4
14	2.9	3.2	4.3	3.3	3.4	2.5	2.4	5.0	2.8	2.7	2.2	2.4
15	2.9	3.3	4.4	3.3	3.1	2.7	4.8	4.8	2.6	2.8	2.2	2.4
16	2.9	3.5	5.1	3.8	3.0	3.3	3.4	3.0	2.5	2.5	2.2	2.9
17	2.8	3.6	8.5	4.0	3.0	2.8	2.6	3.5	2.3	2.5	2.2	4.1
18	2.8	3.5	6.0	4.6	3.0	2.6	2.4	3.0	2.3	2.4	2.9	3.6
19	2.9	3.4	4.2	3.6	3.0	2.6	2.3	2.4	2.8	2.3	2.9	3.1
20	3.0	3.5	3.9	3.6	3.0	3.0	2.3	2.9	2.4	2.3	2.5	2.9
21	3.0	3.6	3.7	3.5	3.1	2.7	2.3	2.9	2.5	2.3	2.4	2.8
22	3.1	4.0	3.7	3.4	3.0	2.6	2.3	2.3	2.3	2.3	2.4	2.8
23	2.9	3.6	3.6	3.3	3.0	2.5	2.2	2.5	2.2	2.3	2.4	2.4
24	2.8	3.5	3.6	3.3	2.9	2.4	2.2	2.4	2.2	2.3	2.3	2.1
25	2.9	4.4	3.5	3.3	2.9	2.4	2.3	2.3	5.9	2.2	2.3	2.0
26	2.8	4.6	3.5	3.2	2.8	2.4	2.3	2.3	8.2	2.2	4.6	2.4
27	2.8	3.9	3.5	3.2	2.8	2.4	2.2	2.2	4.6	2.3	4.0	2.4
28	3.0	24.5	3.9	3.1	2.7	2.4	3.1	2.4	3.4	2.5	3.9	2.6
29	4.4	.....	15.0	3.1	2.7	2.3	3.3	3.6	3.6	2.3	3.0	2.6
30	3.9	.....	12.0	3.2	2.6	2.3	2.3	3.1	3.3	2.3	2.6	2.3
31	4.1	.....	6.5	.....	2.6	.....	2.3	2.5	.....	2.3	.....	2.3
1903.												
1	3.0	3.1	7.9	5.8	3.2	4.3	3.0	3.1	2.2	2.2	2.3	2.2
2	3.1	3.0	5.2	4.4	3.1	4.6	2.9	2.7	2.2	2.2	2.3	2.2
3	3.9	3.6	4.0	4.2	3.1	6.0	3.0	3.1	2.2	2.2	2.9	2.2
4	3.7	7.0	3.7	4.4	3.7	4.5	3.4	3.5	2.1	2.2	3.1	2.3
5	3.4	7.8	3.6	4.0	3.5	4.6	2.9	3.7	2.1	2.2	3.0	2.2
6	3.1	5.2	3.7	3.8	3.2	6.1	2.8	3.2	2.1	2.2	3.1	2.3
7	3.0	3.8	3.7	3.7	3.1	8.0	3.3	3.6	2.2	2.2	2.5	2.3
8	2.8	17.6	3.8	4.1	3.1	6.0	2.9	2.5	2.2	2.3	2.4	2.2
9	2.8	11.2	3.6	4.8	3.1	4.8	2.8	2.4	2.2	2.4	2.3	2.2
10	2.8	5.6	4.3	4.1	3.0	4.4	2.7	2.4	2.2	2.3	2.3	2.3
11	2.9	6.5	5.7	3.8	3.0	3.6	2.7	5.3	2.1	2.2	2.3	2.2
12	4.9	10.4	5.8	3.6	2.9	4.8	3.2	3.3	2.1	2.2	2.3	2.2
13	4.7	7.5	4.6	3.6	3.0	3.9	5.5	2.7	2.1	2.2	2.3	2.3
14	3.5	4.4	3.9	6.8	3.2	3.3	4.9	2.7	2.1	2.2	2.3	2.5
15	3.2	4.0	3.7	5.5	3.6	3.2	3.3	4.7	3.2	2.2	2.3	2.3
16	3.1	3.8	3.6	4.0	3.3	3.1	2.9	4.0	4.4	2.2	2.3	2.3
17	2.9	13.1	3.4	3.7	3.1	3.1	2.8	2.9	4.3	2.3	2.3	2.2
18	2.9	12.7	3.4	3.6	3.1	3.0	2.7	7.3	3.2	2.6	2.4	2.2
19	2.8	4.9	3.3	3.5	3.0	3.0	2.7	4.0	2.6	2.4	2.3	2.1
20	2.8	4.1	3.2	3.5	3.0	2.9	2.6	3.6	2.5	2.3	2.3	2.2
21	2.9	3.8	4.1	3.5	3.2	3.1	2.6	2.8	2.5	2.3	2.3	2.5
22	2.8	3.7	5.5	3.4	3.0	2.9	2.5	2.7	2.4	2.2	2.3	2.4
23	2.7	3.5	13.2	3.4	3.0	2.8	2.5	2.6	2.4	2.2	2.2	2.3
24	2.9	3.4	21.0	3.3	2.9	2.8	2.5	2.5	2.4	2.2	2.2	2.2
25	3.1	3.3	10.7	3.3	2.9	2.7	2.4	2.5	2.3	2.2	2.2	2.3
26	3.0	3.3	5.0	3.4	2.8	2.7	2.4	2.5	2.3	2.2	2.2	2.7
27	2.9	3.2	4.4	3.4	2.8	3.1	2.4	2.4	2.3	2.2	2.2	2.5
28	3.1	6.0	4.2	3.3	2.9	5.6	2.3	2.4	2.3	2.1	2.2	2.4
29	3.7	.....	5.4	3.3	2.8	3.6	2.4	2.4	2.2	2.1	2.2	2.3
30	4.3	.....	9.0	3.2	2.9	3.3	2.7	2.3	2.2	2.1	2.2	2.2
31	3.4	.....	9.0	.....	4.0	.....	2.8	2.3	.....	2.2	.....	2.2
1904.												
1	2.2	2.6	2.6	2.5	2.2	2.4	2.1	1.6	1.9	1.5	1.6	1.9
2	2.2	2.5	2.6	2.5	2.2	2.5	2.0	2.6	1.9	1.5	1.6	2.0
3	2.3	2.4	2.8	2.5	2.1	2.1	1.9	2.4	1.8	1.5	1.7	2.5
4	2.3	2.4	2.8	2.4	2.1	2.0	1.8	2.0	2.4	1.5	1.9	2.1
5	2.2	2.3	2.6	2.4	2.1	1.9	1.7	1.9	3.2	1.5	2.1	2.4
6	2.2	2.3	2.6	2.4	2.1	1.9	1.7	2.8	2.8	1.5	2.0	4.2
7	2.2	2.5	3.7	2.6	2.2	2.1	1.6	2.5	2.7	1.5	1.8	3.2
8	2.2	3.4	5.7	2.6	2.2	2.2	1.6	6.5	2.1	1.5	1.7	2.6
9	2.2	3.1	4.8	2.7	3.5	1.9	4.2	10.4	2.0	1.5	1.7	2.4
10	2.2	3.0	3.4	2.5	3.0	1.9	2.7	6.3	1.9	1.5	1.6	2.2
11	2.3	3.3	3.0	2.5	2.4	1.8	2.0	4.2	1.8	1.5	1.6	2.3
12	2.3	3.0	2.8	2.4	2.2	1.8	2.0	3.3	1.8	1.5	1.6	2.1
13	2.4	2.7	2.7	2.4	2.2	1.8	2.0	3.0	1.8	1.5	2.0	2.0
14	2.4	2.6	2.9	2.3	2.1	1.8	1.8	2.7	1.7	1.5	2.2	2.0
15	2.3	2.6	3.0	2.3	2.1	1.7	1.7	2.5	1.7	1.5	2.0	2.0

aily gage height, in feet, of Broad River (of Georgia) near Carlton—Continued.

)ay.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
904.												
.....	2.2	2.5	2.8	2.3	2.1	1.7	1.6	2.6	1.7	1.5	1.9	2.0
.....	2.3	2.5	2.7	2.4	2.0	1.7	2.1	2.4	1.6	1.5	1.9	2.0
.....	2.5	2.4	2.6	2.4	2.0	1.6	1.8	2.2	1.6	1.5	1.8	2.0
.....	2.4	2.4	2.6	2.3	2.0	1.8	1.6	2.1	1.6	1.5	1.8	2.0
.....	2.2	3.6	2.5	2.3	2.0	1.7	1.5	4.2	1.6	1.5	1.7	1.9
.....	2.2	3.3	2.5	2.4	1.9	2.5	1.5	2.9	1.6	1.5	1.7	1.9
.....	2.2	4.8	4.0	2.3	1.9	2.1	1.6	2.1	2.1	1.5	1.7	1.9
.....	3.8	4.6	3.4	2.3	1.9	2.0	1.9	2.0	1.6	1.5	1.9	1.9
.....	3.2	3.7	4.3	2.2	1.9	1.7	1.8	1.9	1.6	1.5	2.3	1.9
.....	2.7	3.4	3.5	2.2	1.8	1.7	1.6	1.9	1.6	1.5	2.0	2.0
.....	2.5	2.9	3.3	2.3	1.8	1.6	2.6	1.9	1.6	1.6	1.9	2.1
.....	2.4	2.8	3.0	2.4	1.8	1.6	1.9	3.1	1.6	1.7	1.8	2.1
.....	2.4	2.7	2.9	2.3	1.8	1.6	1.7	3.3	1.6	1.7	1.8	3.3
.....	2.5	2.6	2.7	2.2	1.8	1.9	3.0	2.9	1.6	1.6	1.7	3.0
.....	2.6	.....	2.6	2.2	3.0	2.3	1.8	2.2	1.5	1.6	1.7	2.5
.....	2.5	.....	2.6	.....	3.4	.....	1.6	2.0	.....	1.6	.....	2.3
905.												
.....	2.2	2.0	2.5	2.1	2.2	2.3	6.3	1.7	1.6	1.4	1.65	1.7
.....	2.2	2.0	2.5	2.1	2.1	2.1	4.3	1.6	3.0	1.5	1.65	1.7
.....	2.2	2.0	2.5	2.1	2.2	2.1	3.0	1.6	2.4	1.6	1.65	9.4
.....	2.1	2.0	2.4	2.1	5.3	2.0	2.2	1.6	2.0	2.0	1.6	8.4
.....	2.0	2.0	2.4	2.2	3.4	2.0	2.4	1.6	1.7	2.2	1.6	4.2
.....	2.0	2.2	2.4	2.3	4.9	1.9	8.2	1.6	1.7	1.7	1.6	3.5
.....	2.6	2.6	2.3	2.2	6.8	1.9	3.6	1.6	1.7	1.6	1.7	3.0
.....	2.7	3.0	2.3	2.1	6.9	1.9	2.8	1.6	1.6	1.5	1.65	2.5
.....	2.4	4.0	2.3	2.2	4.4	1.8	2.0	3.1	1.6	1.5	1.65	7.0
.....	2.2	5.7	2.5	2.2	3.4	1.8	2.0	2.2	1.6	1.6	1.8	7.9
.....	2.2	5.4	2.4	2.1	2.8	1.8	3.9	2.7	1.6	2.0	2.0	5.4
.....	2.8	4.4	2.5	2.1	2.5	1.7	3.6	3.2	1.6	2.6	1.8	4.3
.....	6.1	6.6	2.6	2.2	2.4	2.1	5.0	4.0	2.3	2.2	1.7	3.3
.....	6.0	6.4	2.5	2.2	2.3	1.9	4.4	2.6	1.9	1.8	1.7	2.9
.....	3.5	4.7	2.4	2.1	2.2	3.0	3.8	2.6	1.7	1.7	1.7	3.0
.....	3.0	3.3	2.4	2.1	2.3	2.0	3.0	2.4	1.6	1.7	1.6	3.0
.....	2.7	3.0	2.3	2.1	2.7	2.0	2.5	2.0	1.6	1.7	1.6	2.7
.....	2.6	2.9	2.2	2.1	2.5	2.0	2.3	2.0	1.5	1.65	1.6	2.6
.....	2.4	2.8	2.2	2.0	2.4	2.0	2.1	2.2	1.5	1.7	1.6	2.6
.....	2.6	3.0	2.2	2.0	2.2	2.7	2.6	2.0	1.5	1.7	1.65	4.3
.....	2.5	7.8	2.3	2.0	2.2	1.9	2.0	1.9	1.5	1.7	1.95	7.8
.....	2.4	8.5	2.3	2.0	2.2	2.2	2.5	1.9	1.5	1.6	1.9	5.7
.....	2.2	5.0	2.3	2.0	2.4	2.0	2.3	1.8	1.5	1.6	1.7	3.0
.....	2.2	3.7	2.3	2.0	4.5	2.0	2.0	2.2	1.4	1.6	1.7	2.5
.....	2.1	3.3	2.3	2.0	4.4	1.9	1.8	2.2	1.4	1.6	1.7	2.4
.....	2.1	3.0	2.2	2.0	2.9	1.9	1.8	2.8	1.4	1.8	2.1	2.3
.....	2.1	2.8	2.2	2.0	2.8	1.7	1.8	2.6	1.4	2.0	2.1	2.2
.....	2.1	2.7	2.1	2.0	2.7	1.7	1.7	2.2	1.4	1.8	1.95	2.2
.....	2.0	.....	2.1	2.0	2.8	1.7	1.7	1.9	1.4	1.75	1.8	3.3
.....	2.0	.....	2.1	2.1	2.6	1.6	1.7	1.7	1.4	1.7	1.75	2.9
.....	2.0	.....	2.1	.....	2.3	.....	1.7	1.7	.....	1.7	.....	2.6

Rating tables for Broad River (of Georgia) near Carlton.

JULY 1 TO DECEMBER 31, 1897.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	315	2.50	973	3.50	1,683	4.50	2,393
1.60	360	2.60	1,044	3.60	1,754	4.60	2,464
1.70	410	2.70	1,115	3.70	1,825	4.70	2,535
1.80	476	2.80	1,186	3.80	1,896	4.80	2,606
1.90	547	2.90	1,257	3.90	1,967	4.90	2,677
2.00	618	3.00	1,328	4.00	2,038	5.00	2,748
2.10	689	3.10	1,399	4.10	2,109	5.50	3,100
2.20	760	3.20	1,470	4.20	2,180	6.00	3,460
2.30	831	3.30	1,541	4.30	2,251		
2.40	902	3.40	1,612	4.40	2,322		

JANUARY 1 TO DECEMBER 31, 1898.[b]

1.40	320	3.20	1,600	5.00	3,364	8.40	6,696
1.50	352	3.30	1,698	5.20	3,560	8.60	6,892
1.60	385	3.40	1,796	5.40	3,756	8.80	7,088
1.70	432	3.50	1,894	5.60	3,952	9.00	7,284
1.80	480	3.60	1,992	5.80	4,148	9.20	7,480
1.90	527	3.70	2,090	6.00	4,344	9.40	7,676
2.00	577	3.80	2,188	6.20	4,540	9.60	7,872
2.10	638	3.90	2,286	6.40	4,736	9.80	8,064
2.20	700	4.00	2,384	6.60	4,932	10.00	8,264
2.30	775	4.10	2,482	6.80	5,128	11.00	9,244
2.40	850	4.20	2,580	7.00	5,324	12.00	10,224
2.50	940	4.30	2,678	7.20	5,520	13.00	11,204
2.60	1,030	4.40	2,776	7.40	5,716	14.00	12,184
2.70	1,122	4.50	2,874	7.60	5,912	15.00	13,164
2.80	1,215	4.60	2,972	7.80	6,108	16.00	14,144
2.90	1,310	4.70	3,070	8.00	6,304	17.00	15,124
3.00	1,405	4.80	3,168	8.20	6,500	18.00	16,104
3.10	1,502	4.90	3,266				

JANUARY 1, 1899, TO DECEMBER 31, 1901.[c]

1.90	490	3.70	1,760	6.00	4,160	10.00	9,550
2.00	540	3.80	1,840	6.20	4,420	10.50	10,225
2.10	600	3.90	1,920	6.40	4,690	11.00	10,900
2.20	660	4.00	2,000	6.60	4,960	11.50	11,575
2.30	730	4.10	2,090	6.80	5,230	12.00	12,250
2.40	800	4.20	2,180	7.00	5,500	12.50	12,925
2.50	870	4.30	2,270	7.20	5,770	13.00	13,600
2.60	940	4.40	2,360	7.40	6,040	13.50	14,275
2.70	1,010	4.50	2,450	7.60	6,310	14.00	14,950
2.80	1,080	4.60	2,550	7.80	6,580	15.00	16,300
2.90	1,150	4.70	2,650	8.00	6,850	16.00	17,650
3.00	1,220	4.80	2,750	8.20	7,120	17.00	19,000
3.10	1,295	4.90	2,850	8.40	7,390	18.00	20,350
3.20	1,370	5.00	2,950	8.60	7,660	19.00	21,700
3.30	1,445	5.20	3,160	8.80	7,930	20.00	23,050
3.40	1,520	5.40	3,390	9.00	8,200	21.00	24,400
3.50	1,600	5.60	3,640	9.50	8,875	22.00	25,750
3.60	1,680	5.80	3,900				

[a] Above gage height 1.80 feet the rating curve is a tangent, the difference being 71 per tenth.
[b] Above gage height 3.10 feet the rating curve is a tangent, the difference being 98 per tenth.
[c] Above gage height 6.20 feet the rating curve is a tangent, the difference being 135 per tenth.

Rating tables for Broad River (of Georgia) near Carlton—Continued.

JANUARY 1 TO DECEMBER 31, 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	420	2.70	870	3.30	1,365	3.90	1,890
2.20	490	2.80	950	3.40	1,450	4.00	1,980
2.30	565	2.90	1,030	3.50	1,535	4.10	2,070
2.40	640	3.00	1,110	3.60	1,620	4.20	2,165
2.50	715	3.10	1,195	3.70	1,710	4.30	2,260
2.60	790	3.20	1,280	3.80	1,800	4.40	2,355

JANUARY 1 TO DECEMBER 31, 1903.[b]

2.10	575	2.80	1,030	3.50	1,570	4.20	2,180
2.20	630	2.90	1,105	3.60	1,655	4.30	2,270
2.30	690	3.00	1,180	3.70	1,740	4.40	2,365
2.40	755	3.10	1,255	3.80	1,825	4.50	2,460
2.50	820	3.20	1,330	3.90	1,910	4.60	2,555
2.60	890	3.30	1,410	4.00	2,000	4.70	2,650
2.70	960	3.40	1,490	4.10	2,090	4.80	2,750

JANUARY 1, 1904, TO DECEMBER 31, 1905.

1.40	270	2.60	850	3.80	1,770	5.80	3,840
1.50	305	2.70	920	3.90	1,860	6.00	4,100
1.60	340	2.80	990	4.00	1,950	6.50	4,750
1.70	380	2.90	1,060	4.20	2,130	7.00	5,400
1.80	420	3.00	1,130	4.40	2,320	7.50	6,100
1.90	460	3.10	1,200	4.60	2,520	8.00	6,800
2.00	510	3.20	1,280	4.80	2,720	8.50	7,500
2.10	560	3.30	1,360	5.00	2,920	9.00	8,200
2.20	610	3.40	1,440	5.20	3,140	9.50	8,950
2.30	670	3.50	1,520	5.40	3,360	10.00	9,700
2.40	730	3.60	1,600	5.60	3,600	10.50	10,450
2.50	790	3.70	1,680				

[a] Above gage height 4.40 feet the above table is the same as the 1899 to 1901 table.
[b] Above gage height 4.80 feet this rating table is the same as the 1899 to 1901 table.

Estimated monthly discharge of Broad River (of Georgia) near Carlton.

[Drainage area, 762 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1897.					
July	3,671	443	979	1.28	1.4
August	2,428	385	641	0.84	0.9
September	831	315	380	0.50	0.5
October	973	315	468	0.61	0.7
November	1,434	385	547	0.72	0.8
December	1,115	547	748	0.98	1.1
1898.					
January	3,462	505	887	1.16	1.3
February	738	505	575	0.75	0.8
March	2,776	505	730	1.00	1.1
April	3,609	577	1,078	1.41	1.5
May	700	385	524	0.69	0.7
June	850	300	422	0.55	0.6
July	7,284	300	1,455	1.91	2.2
August	5,275	480	1,533	2.01	2.3
September	16,937	666	2,961	3.89	4.3
October	9,440	632	1,786	2.34	2.7
November	1,943	775	1,099	1.44	1.6
December	3,217	850	1,319	1.73	1.9
The year	16,937	300	1,197	1.57	21.4
1899.					
January	4,757	975	1,599	2.10	2.4
February	17,380	1,220	3,602	4.73	4.9
March	14,815	1,407	2,870	3.77	4.3
April	3,900	1,257	1,622	2.13	2.3
May	1,370	870	1,072	1.41	1.6
June	1,760	730	957	1.26	1.4
July	4,825	570	943	1.24	1.4
August	2,090	490	721	0.95	1.0
September	1,840	490	654	0.86	0.9
October	2,270	490	684	0.90	1.0
November	1,760	570	771	1.01	1.1
December	2,360	660	940	1.23	1.4
The year	17,380	490	1,370	1.80	24.1
1900.					
January	3,965	730	1,146	1.50	1.7
February	26,020	730	3,468	4.55	4.7
March	5,230	1,220	2,171	2.85	3.2
April	12,520	1,010	2,651	3.48	3.8
May	2,650	940	1,168	1.53	1.7
June	13,600	870	2,994	3.93	4.3
July	1,920	870	1,227	1.61	1.8
August	2,000	660	958	1.26	1.4
September	3,510	540	908	1.19	1.3
October	2,950	600	1,001	1.31	1.5
November	4,825	730	1,043	1.37	1.5
December	2,950	800	1,155	1.52	1.7
The year	26,020	540	1,658	2.18	29.2
1901.					
January	11,575	940	2,093	2.75	3.1
February	6,715	1,010	1,697	2.23	2.3
March	15,288	870	2,266	2.97	3.4
April	12,182	1,080	2,421	3.18	3.5
May	6,715	870	1,673	2.20	2.5
June	11,170	1,010	2,354	3.09	3.4
July	4,550	800	1,270	1.67	1.9
August	9,550	730	3,196	4.19	4.8
September	16,030	1,010	2,153	2.82	3.1
October	2,750	870	1,083	1.42	1.6
November	1,010	870	898	1.18	1.3
December	22,915	870	2,769	3.63	4.1
The year	22,915	730	1,989	2.61	35.4

Estimated monthly discharge of Broad River (of Georgia) near Carlton—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1902.					
January	2,650	950	1,304	1.71	1.97
February	29,125	1,280	4,514	5.92	6.16
March	27,370	1,535	4,225	5.54	6.39
April	2,550	1,195	1,579	2.07	2.31
May	1,710	790	1,163	1.53	1.76
June	1,365	565	800	1.05	1.17
July	2,750	490	764	1.00	1.15
August	2,950	420	919	1.21	1.39
September	7,120	420	1,227	1.61	1.80
October	1,890	490	837	1.10	1.27
November	2,550	420	777	1.02	1.14
December	4,960	790	1,479	1.94	2.24
The year	29,125	420	1,632	2.14	28.75
1903.					
January	2,850	960	1,375	1.81	2.09
February	19,810	1,180	4,638	6.09	6.34
March	24,400	1,330	4,110	5.39	6.21
April	5,230	1,330	2,007	2.63	2.93
May	2,000	1,030	1,270	1.67	1.93
June	6,850	960	2,125	2.79	3.11
July	3,510	690	1,150	1.51	1.74
August	5,905	690	1,387	1.82	2.10
September	2,365	575	818	1.07	1.19
October	890	575	651	.85	.98
November	1,255	630	750	.98	1.09
December	960	575	683	.90	1.04
The year	24,400	575	1,747	2.29	30.75
1904.					
January	1,770	610	741	.972	1.12
February	2,720	670	1,113	1.46	1.58
March	3,720	790	1,247	1.64	1.89
April	920	610	720	.945	1.05
May	1,520	420	629	.825	.951
June	790	340	478	.627	.700
July	2,130	305	522	.685	.790
August	10,300	340	1,409	1.85	2.13
September	1,280	305	471	.618	.690
October	380	305	314	.412	.475
November	670	340	434	.570	.636
December	2,130	460	688	.903	1.04
The year	10,300	305	730	.959	13.05
1905.					
January	4,230	510	934	1.23	1.42
February	7,500	510	2,046	2.69	2.80
March	850	560	687	.902	1.04
April	670	510	555	.728	.812
May	5,270	560	1,392	1.83	2.11
June	1,130	340	514	.675	.753
July	7,080	380	1,277	1.68	1.94
August	1,950	340	630	.827	.953
September	1,130	270	382	.501	.559
October	850	270	407	.534	.616
November	560	340	397	.521	.581
December	8,800	380	2,184	2.87	3.31
The year	8,800	270	950	1.25	16.89

BROAD RIVER (SOUTH FORK) NEAR CARLTON.

This station was established as a bench-mark station. It is located at Bull Rat Rock, about 1 mile south of Carlton, Ga. Discharge measurements are made at a shoal about 100 yards above the rock by means of a boat. The initial point for soundings is a small sweet-gum tree on the left bank. The channel is curved for 200 feet above and 500 feet below the station. The current is sluggish. The right bank is cultivated and the left is wooded. Both banks are subject to overflow at rare intervals. The bed of the stream is composed of rock and is very rough. The bench mark is composed of three copper nails driven into the gum tree, which forms the initial point for sounding. Its elevation is 5.00 feet above datum.

Discharge measurements of Broad River (South Fork) near Carlton.

Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*
July 20	1.00	41
September 7	1.20	115

MISCELLANEOUS MEASUREMENTS IN SAVANNAH RIVER DRAINAGE BASIN.

Broad River (South Fork).—A measurement was made May 4, 1904, at the foot of the shoals below Watson's mill near Carlton, as follows:

Width, 50 feet; area, 81 square feet; mean velocity, 1.28 feet per second; discharge, 104 second-feet. The gage at Carlton read 2.20 feet.

The following measurement was made March 16, 1904, at the Seaboard Air Line railroad bridge, 1½ miles west of Comer. The bench mark is the top of the girder at sounding point 30. Its elevation is 49.00 feet above the datum of the gage.

Width, 74 feet; area, 68 square feet; mean velocity, 1.56 feet per second; gage height, 1.18 feet; discharge, 106 second-feet.

Chattooga River.—This river joins the Tallulah River and forms Tugaloo River. The following measurement was made November 16, 1905, from a small boat at a point about 5 miles northeast of Tallulah Falls, at a narrow channel about 1,000 feet below Atkins Ferry and opposite B. H. Atkins's residence. There is a small shoal about 150 feet below and one 300 feet above the point of measurement. At the time of flood in 1876 the water is said to have been 36 to 40 feet higher than the present stage and did much damage to property. The bench mark is the center of the head of a wire nail driven horizontally into a sycamore stump, which stands on the right bank about 200 feet above the point of measurement; elevation, 6.13

feet above the datum of the assumed gage. The gage height at the same time at the regular station on Tallulah River at Tallulah Falls was 0.82 foot.

Width, 107 feet; area, 442 square feet; mean velocity, 0.77 foot per second; gage height, 2.00 feet; discharge, 339 second-feet.

Chauga River.—This stream was measured in 1903 at Bryan's bridge, 2 miles east of Fort Madison, S. C. The bench mark is a spike in a sycamore sapling 100 feet above bridge on left bank.

Discharge measurements of Chauga Creek 1 mile east of Fort Madison, S. C.

Date.	Height of bench mark above water.	Discharge.
1903.	*Feet*	*Sec.-ft.*
August 29	3.00	168
September 24	3.25	133

Clouds Creek.—This stream is tributary to Broad River. The following measurement was made May 4, 1904, below the ford on the public road one-half mile east of Watson's mill, near Carlton.

Width, 36 feet; area, 36 square feet; mean velocity, 1 foot per second; discharge, 36 second-feet. The gage at Carlton read 2.20 feet.

Eighteenmile Creek.—This stream was measured 3½ miles southeast of Calhoun, S. C. The bench mark is the top of downstream end of cap, 35 feet from right-bank end of bridge.

Discharge measurements of Eighteenmile Creek 3½ miles southeast of Calhoun, S. C.

Date.	Height of bench mark above water.	Discharge.
1903.	*Feet.*	*Sec.-ft.*
July 11	5.43	392
July 30	8.12	48
September 23	8.08	51

Keowee River.—Keowee River is tributary to Seneca River from the north near Seneca, S. C. The following measurement was made January 16, 1904, from the Lawrence Bridge, 5 miles northwest of Calhoun. The bench mark is the top of the upstream end of the first iron cross beam from the right bank, 27.00 feet above the datum of the gage.

Width, 144 feet; area, 620 square feet; mean velocity, 1.11 feet per second; gage height, 2.91 feet; discharge, 691 second-feet.

Little River.—Two measurements were made June 6, 1905, near Washington. The bench mark is the top of the downstream wooden stringer under the cross-ties at the center of the first span of the railroad bridge at the right bank; elevation, 29.00 feet above the datum of the assumed gage.

Measurement at bridge of Washington Branch of Georgia Railroad: Width, 37 feet; area, 59 square feet; mean velocity, 0.58 foot per second; gage height, 1.40 feet; discharge, 34 second-feet.

Measurement at wagon bridge, 400 feet above railroad bridge: Width, 47 feet; area, 185 square feet; mean velocity, 0.19 foot per second; gage height, 1.40 feet; discharge, 35 second-feet.

Panther Creek.—The following measurement was made June 22, 1905, a short distance below where the Tallulah Falls Railroad crosses Panther Creek, near Tallulah Falls. The stage of the creek was probably somewhat high at the time of gaging, owing to showers the day before.

Width, 9 feet; area, 5.85 square feet; mean velocity, 1.17 feet per second; discharge, 6.82 second-feet.

Tiger Creek.—This stream is tributary to Tallulah River from the north, entering near Tallulah Falls. The following measurement was made June 13 from the railroad trestle, one-fourth mile northwest of Wiley.

Width, 14 feet; area, 11 square feet; mean velocity, 1.12 feet per second; discharge, 12.3 second-feet.

Tugaloo River.—The following measurement was made November 18, 1905, at Prathers Bridge, about 8 miles above the Southern Railway Bridge near Madison, S. C. The initial point for soundings is the left end of the upstream guard rail at the end of the approach. The bench mark is the top of the upstream end of the second wooden cross beam from the left end of the bridge; elevation, 28.38 feet above the datum of the assumed gage. The gage height at the time by the gage at the regular station near Madison was 2.14 feet.

Width, 137 feet; area, 276 square feet; mean velocity, 2.22 feet per second; gage height, 2.15 feet; discharge, 614 second-feet.

Twelvemile Creek.—This stream was measured 1 mile northwest of Calhoun, S. C. The bench mark is the top of downstream corner of left-bank pier.

Discharge measurements of Twelvemile Creek 1 mile northwest of Calhoun, S. C.

Date.	Height of bench mark above water.	Discharge.
1905.	*Feet.*	*Sec.-ft.*
July 11	4.45	5
July 30	5.13	25
September 23	5.91	8

RIVER SURVEYS IN SAVANNAH RIVER DRAINAGE BASIN.

TALLULAH RIVER.

The elevations in the following list are based on a bronze tablet in rock 70 feet east of public road and 20 feet south of Tallulah Falls station, marked "1569 ATLANTA," the elevation of which is accepted

02 feet above mean sea level in accord with the 1903 adjust-
he precise level net. The line is corrected to accord with
vork at mouth and at Burton.
veling was done in the summer of 1903 by Thomas B.
levelman, under the direction of Carroll Caldwell, field

on Tallulah River in Georgia from mouth near Tallulah Falls up to Blalock.

Description of points.	Elevation above sea level.
	Feet.
ion of Chattooga and Tallulah rivers, water surface	754
t north of junction of rivers, edge of river, point on rock	761.29
t north of junction of rivers, west side of Tugaloo River, gum tree, nail in of	762.65
ooga River, 500 feet north of, west side of Tallulah River, nail in root of oak np	769.46
r surface	767
a of small stream, water surface	782
r surface	818
r surface	848
r surface	878
r surface	893
r surface	911
of rapids, water surface	935
e of rapids, water surface	944
of rapids, water surface	947
of rapids, water surface	954
r surface	964
of small falls, water surface	981
of rapids, water surface	987
et below bend, head of rapids, water surface	980
r surface	997
r surface	1,008
l Veil Falls, foot of, water surface	1,022
of falls, water surface	1,039
r surface	1,057
a Falls, foot of, water surface	1,074
of falls, water surface	1,115
cane Falls, foot of, water surface	1,140
cane Falls, head of, water surface	1,229
esta Falls, foot of, water surface	1,246
esta Falls, head of, water surface	1,322
re Falls, foot of, water surface	1,322
re Falls, head of, water surface	1,350
r surface	1,379
r surface	1,396
on road iron highway bridge, water surface	1,414
lah Falls station, 70 feet east of public road, 20 feet south of station, in rock, aze tablet marked "1569 ATLANTA"	1,568.302
lah Falls, 0.5 mile northeast of, at fork of road, 50 feet south of bridge over r	1,457.92
on road iron highway bridge, floor of	1,441.87
on road iron highway bridge, water surface	1,419
site stone pier railroad bridge, water surface	1,439
of falls, water surface	1,486
f falls, water surface	1,492
r surface	1,509
of island, water surface	1,530
lah Falls Railroad, 20 feet west of, point on top of rock	1,538.21
r surface	1,529
r surface	1,538
r surface	1,553
r surface	1,559
t east of river, in cornfield, dead apple tree, nail in root of	1,579.23
r surface	1,573
r surface	1,578
north of river, in cornfield, walnut tree, nail in root of	1,589.25
r surface	1,578
Creek, on point of land between river and creek, burned poplar tree, nail in of	1,590.30
r surface	1,584
r surface	1,589
west of river, on footpath, point on sharp rock	1,595.59
r surface	1,592
r surface	1,596

Elevations on Tallulah River in Georgia from mouth near Tallulah Falls up to Blalock
Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
10.5	10 feet west of river, nail in root of beech tree	1,601
10.6	Water surface	1,600
10.9	Water surface	1,603
11.8	Crane Ford, 150 feet west of, apple tree, nail in root of	1,620
11.8	Crane Ford, water surface	1,607
12.1	Water surface	1,610
13.3	Dockens Ford, 12 feet west of river, nail in side of dead tree	1,622
13.3	Dockens Ford, water surface	1,615
13.8	Ellerd Ford, 150 feet east of, poplar tree, nail in side of	1,634
13.8	Ellerd Ford, water surface	1,621
14.4	Water surface	1,626
14.5	Water surface	1,628
14.6	Eden Church, 150 feet west of, 150 feet east of river, nail in root of large red-oak tree	1,649
15.6	Taylor Shoals, 10 feet west of river, middle of, point on large flat rock	1,644
15.6	Taylor Shoals, water surface	1,641
16.2	Water surface	1,648
16.5	Water surface	1,657
16.6	Water surface	1,657
17.7	James Smith boat landing, 2 feet west of river, nail in stump	1,670
18.4	Fall Creek, mouth of, water surface	1,669
18.6	Jones Ford, 6 feet south of river, slanting persimmon tree, nail in side of	1,677
18.6	Jones Ford, water surface	1,674
19.2	Flat Creek, mouth of, water surface	1,681
20.6	Water surface	1,667
20.9	Cliff Creek, mouth of, water surface	1,690
21.4	Water surface	1,697
21.5	Denton Ford, 10 feet west of river, nail in root of pine tree	1,703
21.5	Denton Ford, water surface	1,701
21.8	Mouth of small stream	1,703
21.9	Seal Creek, mouth of, foot of double shoals, water surface	1,704
22.0	Water surface	1,707
22.3	Middle of shoals, water surface	1,714
22.6	Crow Ford, 100 feet south of, 10 feet south of river, twin hemlock tree, nail in root of	1,725
22.6	Crow Ford, water surface	1,724
22.7	Scarecrow Creek, mouth of, water surface	1,727
24.0	George Creek, mouth of, water surface	1,737
24.5	Bridge Creek, mouth of, water surface	1,738
25.0	In shoals, water surface	1,747
25.1	Ford, water surface	1,749
25.1	Above ford, south edge of river, point on rock	1,750
25.6	Rocky Ford, 10 feet south of, dead hemlock tree, nail in root of	1,758
25.6	Rocky Ford, water surface	1,756
25.9	Water surface	1,757
26.2	Kenny Creek, mouth of, water surface	1,760
26.3	Fuller Ford, water surface	1,760
26.4	Fuller Ford, 500 feet northwest of, point on rock	1,762
27.0	Water surface	1,767
27.3	Cannon Ford, 75 feet southwest of, nail in foot of white oak	1,781
27.3	Cannon Ford, water surface	1,769
28.2	Ford, west side of, nail in root of red-gum tree	1,777
28.2	Ford, water surface	1,774
28.5	Wildcat Creek, 50 feet southwest of, west side of road, point on rock	1,783
28.5	Wildcat Creek, water surface	1,776
29.3	Water surface	1,785
29.5	Water surface	1,787
29.6	Mouth of Dicks Creek, water surface	1,789
30.1	Burton, 12 feet southwest of bridge, nail in root of maple tree	1,794
30.1	Burton, floor of bridge	1,806
30.1	Burton, water surface	1,790
30.1	Burton, high water	1,804
30.2	Burton, 1,000 feet above bridge, 15 feet east of river, 10 feet west of road, bronze tablet	1,795
32.1	12 feet west of ford, nail in side of ash tree	1,811
32.1	Water surface	1,813
32.4	Water surface	1,811
32.7	Mur Ford, 100 feet southwest of, nail in west side of white-oak tree	1,833
32.7	Mur Ford, water surface	1,824
33.0	Rocky Ford, water surface	1,821
33.1	Shallow Ford, 500 feet southeast of, in road, point on rock	1,841
33.2	Water surface	1,833
33.6	Deep Ford, 30 feet south of, nail in side of sycamore tree	1,842
33.6	Deep Ford, water surface	1,838
34.3	Popcorn Creek, mouth of	1,848
35.8	Persimmon Creek, 75 feet east of river, 30 feet south of creek, nail in side of hickory tree	1,883

SURVEY OF TUGALOO AND SAVANNAH RIVERS.

The elevations in the following list are based on an aluminum tablet marked "1050 M. C.," at the Washington street entrance to the State capitol at Atlanta, the elevation of which is accepted as 1,049.546 feet above mean sea level. The initial point on which these levels depend is a bronze tablet at the north side of east entrance at courthouse at Clarksville, Ga., marked "1373 ATLANTA," the elevation of which is accepted as 1,371.991 feet above mean sea level, in accordance with the 1903 adjustment of the precise level net.

The leveling on Tugaloo, and on Savannah River from Tugaloo River to Broad River, was done in the summer of 1903, under the direction of Carroll Caldwell, field assistant, by Thomas B. O'Hagan, levelman.

The survey of Savannah River from Broad River to Augusta, Ga., was made by C. M. Pritchett, in January, 1903, for the United States Geological Survey.

Elevations on Tugaloo and Savannah rivers from head of Tugaloo River to Augusta.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0.0	Nail in root of gum tree, west side of Tallulah River, 200 feet northwest of junction of Tallulah and Chattooga rivers	762.65
0.0	Point on rock, edge of river, 100 feet northwest of junction of Tallulah and Chattooga rivers	761.29
0.0	Point on rock, edge of river, 100 feet northwest of junction of Tallulah and Chattooga rivers, water surface	754
	TUGALOO RIVER TO JUNCTION WITH SENECA RIVER.	
0.7	Nail in root of pine tree, below head of Tugaloo River	728.86
0.7	Head of island, water surface	723
0.8	Water surface	711
2.0	Water surface	698
2.0	Point on rock, west side of river	698.79
2.1	Water surface	690
2.4	Water surface	686
2.8	Nail in root of hickory tree	690.51
2.8	Water surface	684
2.9	Water surface	681
3.1	Mouth of small stream, water surface	674
4.4	Mouth of Panther Creek, water surface	669
4.4	Bronze tablet marked "715 ATLANTA," in large rock, west edge of public road, 600 feet south of mouth of Panther Creek, 50 feet west of river	713.793
5.3	Water surface	667
5.4	Dieton Ford, water surface	666
5.0	Water surface at small bridge	664
5.4	Nail in root of walnut tree	676.45
6.3	Water surface	659
6.4	Mouth of small creek, South Carolina side, water surface	655
7.4	Nail in root of walnut tree, 100 feet west of river	664.87
7.5	Water surface at small boat landing	652
8.0	Mouth of Big John Creek, water surface	650
8.9	Nail in side of cottonwood tree, Prather's Bridge, 100 feet northwest of river and old bridge	659.02
8.9	Water surface	648
9.9	Bronze tablet marked "728 ATLANTA," middle step, front entrance, James Prather homestead	726.873
10.5	Mouth of stream	646
11.5	Nail in root of apple tree, 600 feet west of river	657.40
11.5	Water surface	644
13.0	Mouth of stream	642
13.0	Nail in root of gum tree, 10 feet west of river	658.51
13.8	Nail in root of gum tree, west edge of river	651.33
13.8	Mouth of Toccoa Creek, water surface	641
13.9	Jarrett Bridge, water surface	641

Elevations on Tugaloo and Savannah rivers from head of Tugaloo River to Augusta

TUGALOO RIVER TO JUNCTION WITH SENECA RIVER—Continued.

Distance.	Description of points.	El ab
Miles.		
15.4	Nail in root of water-oak tree 4 feet east of river	
15.4	Nail in root of walnut tree, 50 feet west of railroad bridge	
15.4	Bronze tablet marked "666 ATLANTA," west abutment of railroad bridge crossing river	
16.0	Mouth of stream, water surface	
16.4	Mouth of stream, water surface	
16.5	Nail in root of sycamore tree, 50 feet south of river	
16.5	Mouth of stream	
17.5	Nail in root of birch tree, 50 feet east of river	
18.0	Water surface	
18.0	Nail in root of walnut tree, 100 feet west of river, 200 feet east of county road	
19.0	Mouth of stream opposite sawmill, water surface	
19.1	Nail in root of walnut tree	
20.1	Mouth of stream, water surface	
21.3	Nail in top of swamp bush, 3 feet northwest of river	
21.7	Nail in root of walnut tree, 10 feet south of Rock Creek	
21.7	Water surface	
22.0	Nail in root of walnut tree, 400 feet northwest of Jenkins Ferry, 200 feet west of river	
22.0	Bronze tablet marked "732 ATLANTA," in chimney 2 feet above ground, north side of house, W. J. Perkins's homestead (the above is on a single spur line)	
22.0	Water surface	
22.0	High water	
22.3	Mouth of stream, water surface	
22.4	Nail in stump, walnut tree	
22.6	Nail in root of walnut tree, 40 feet west of river	
23.2	Nail in root of birch tree on edge of small stream	
24.5	Nail in root of small tree, 4 feet west of river	
24.5	Water surface	
25.1	Water surface	
25.5	Nail in root of pine tree, 50 feet west of river	
25.7	Water surface	
26.1	Nail in old stump, 41 feet west of river	
26.3	Head of Shelors Shoals, water surface	
27.6	Nail in root of walnut tree, 10 feet north of river	
27.6	Water surface	
27.9	Water surface	
28.1	Mouth of large creek, water surface	
29.1	Nail in top of pine tree, 5 feet northeast of river	
29.3	Nail in root of water-oak tree, Shelors Ferry, 10 feet northeast of river	
29.3	Water surface	
29.3	Bronze tablet marked "630 ATLANTA" in large rock, 100 feet northwest of I. E. Martin's house, 10 feet north of road, 0.3 mile southwest of Shelors Ferry	
30.1	Mouth of stream, water surface	
30.3	Nail in root of sycamore tree, 10 feet north of river	
30.3	Mouth of stream, near bend in river, water surface	
30.4	Nail in root of water-oak stump, 10 feet north of river	
30.4	Water surface	
31.8	Mouth of Gumlog Creek, water surface	
32.3	Nail in root of apple tree, near middle branch	
32.4	Water surface	
33.1	Water surface	
33.6	Nail in root of maple tree in fork of road, 100 feet west of Knox Bridge	
33.6	Water surface	
33.6	Bronze tablet marked "613 ATLANTA," in chimney, S. A. Glenn's house, 200 feet west of Knox Bridge	
34.3	Water surface	
34.3	Nail in top of dead stump, 25 feet northwest of Shoal Creek	
35.3	Mouth of Shoal Creek, water surface	
35.3	Nail in top of pine stump, 200 feet north of river	
35.4	Mouth of Knox Branch, water surface	
36.1	Nail in root of oak tree, 900 feet north of river	
36.5	Mouth of Burton Branch, water surface	
37.5	South side of river, point on bottom of cliff	
37.8	Nail in root of red-oak tree, 10 feet north of road, 250 feet south of Pullins Ferry	
37.8	Pullins Ferry, water surface	
38.4	Head of Cleveland Shoals, water surface	
39.6	Nail in root of sycamore tree, 10 feet north of river, Averys Ferry	
39.6	Foot of shoals, water surface	
39.8	Point on rock, bottom of cliff, 2 feet south of river	
39.8	Bronze tablet marked "588 ATLANTA" in rock, top of cliff, Averys Ferry, 20 feet south of river	
40.3	Nail in root of walnut tree, 100 feet south of river, Bradberrys Ferry	
40.3	Head of Chandlers Shoals, water surface	
40.7	Point on rock, bottom of cliff, 1 foot south of river	
40.8	Nail in root of beech tree, 1 foot south of river	
40.8	Water surface	
40.9	Mouth of Reed Creek, water surface	

Elevations on Tugaloo and Savannah rivers from head of Tugaloo River to Augusta—Con.

TUGALOO RIVER TO JUNCTION WITH SENECA RIVER—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
41.1	Foot of Chandlers Shoals, water surface	562
41.4	Nail in stump, 900 feet east of Reed Creek, 10 feet south of river	566.95
41.7	Nail in root of birch tree at boat landing	563.72
42.3	Head of Hatten Shoals, water surface	560
42.8	Nail in root of maple tree, 1,000 feet south of F. Clark's house, north edge of river	556.79
42.8	Water surface	555
43.3	Nail in root of beech tree, 25 feet east of Beaverdam Creek	554.01
43.3	Water surface	546
43.7	Nail in root of large pine tree, 5 feet north of river, 25 feet east of small stream	537.07
43.7	Water surface	535
44.2	Point on rock, bottom of cliff, Hatten Ford	526.91
44.2	Water surface	525
44.5	Mouth of branch, water surface	522
44.7	....do	519
45.3	Nail in root of water-oak tree, 30 feet northeast of river	529.36
46.3	Nail in root of beech tree, 15 feet east of river	525.17
46.3	Water surface	519
46.6	Nail in top of burnt stump, 40 feet east of river	524.70
46.6	Water surface	518
47.7	Nail in root of twin beech tree, 15 feet north of river, ½ mile north of Andersonville, S. C	522.27
47.8	Mouth of branch, water surface	516
48.2	Foot of rapids, water surface	511
48.2	Bronze tablet marked "538 ATLANTA," in rock, east side of road, 200 feet east of river, northwest of Little Beaverdam Creek, Andersonville, S. C	537.519
48.2	"Brouris" Ferry, water surface	510
48.2	Point on rock, 20 feet west of river	514.45

SAVANNAH RIVER FROM JUNCTION OF SENECA AND TUGALOO RIVERS TO BROAD RIVER.

48.7	Mouth of Seneca River, water surface	505
48.7	Nail in root of small pine tree	512.60
49.3	Mouth of branch, water surface	501
49.3	Nail in root of sycamore tree, on edge of bank branch and river	502.78
50.5	Mouth of creek, water surface	497
50.7	Nail in top of willow stump, 50 feet west of river, opposite island	503.38
50.7	Mouth of branch	493
51.4	Nail in root of large red-oak tree in footpath, 10 feet west of river	499.76
51.4	Triple water-oak tree, at Lightwood Creek, 400 feet west of river	507.28
52.3	Carters Ferry, water surface	492
52.3	High water	516
52.3	Mouth of Lightwood Creek, water surface	491
52.8	Nail in root of large walnut tree, 60 feet west of river	501.09
53.3	Nail in root of double water-oak tree, 40 feet west of Browns Ferry	497.79
53.3	Water surface	488
53.3	High water	499
53.3	Bronze tablet marked "518 ATLANTA," in brick and stone abutment at rear of O. C. Brown's house, northwest corner, 1,200 feet northeast of Browns Ferry	516.891
54.6	Mouth of Powderbag Creek, water surface	487
54.8	Nail in root of box-elder tree, 520 feet south of creek, 30 feet west of river	491.88
55.0	Dooleys Ferry, nail in root of poplar tree, 114 feet west of river	492.64
55.0	Dooleys Ferry, water surface	486
55.7	Nail in root of maple tree hanging over edge of river, opposite Crafts Island	485.13
55.7	Water surface	485
55.7	Mouth of Long Branch, head of McDaniel Shoals, water surface	484
56.1	Nail in root of large poplar tree, 30 feet south of river	487.61
56.1	Water surface	482
56.1	High-water mark	487.
56.8	Nail in root of pine tree, 70 feet southwest of river	483.26
56.8	Water surface	474
57.3	Nail in root of birch tree, mouth of Turner Creek, southwest of river	473.43
57.3	Water surface	471
57.5	Nail in root of birch tree, 20 feet southwest of river	476.13
57.5	Water surface	470
58.0	Nail in root of red-oak tree bending over edge of river, 0.1 mile west of Harpers Island	472.57
58.7	Foot of McDaniel shoals, water surface	466
59.1	Bronze tablet marked "495 ATLANTA," in cliff, foot of steep hill, west side of ferry road, opposite colored house, 0.2 mile above Parks Ferry	494.435
59.3	Parks Ferry, nail in root of large red-oak tree, 15 feet west of river	468.53
59.3	Parks Ferry, water surface	461
59.5	Water surface	460
60.5	Nail in root of mulberry tree stump, west side of river	462.42
60.5	Water surface	458

Elevations on Tugaloo and Savannah rivers from head of Tugaloo River to Augusta—Con.

SAVANNAH RIVER FROM JUNCTION OF SENECA AND TUGALOO RIVERS TO BROAD RIVER—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
60.8	Saddlers Old Ferry, point on rock, rock cliff, 40 feet west of river	466.38
60.8	Saddlers Old Ferry, water surface	426
60.9	Nail in root of hickory tree, 60 feet south of river	471.37
60.9	Water surface	427
61.5	Nail in root of large black-oak tree, 500 feet north of river at Cedar Creek	469.6
61.5	Mouth of Cedar Creek	425
62.3	Nail in root of white-ash tree, 10 feet west of river, 0.1 mile southwest of Kinleys Ferry	457.0
62.3	Water surface	424
62.4	Head of Turners Shoals, water surface	423
62.5	Mouth of McMullins Branch, water surface	420
64.2	Nail in root of small hickory tree, 50 feet south of river	466.55
64.3	Shoals, water surface	420
65.8	Nail in root of black-oak tree, 200 feet west of river	468.62
65.9	Water surface	443
66.2	Nail in root of black-oak tree, 25 feet west of river	445.89
66.2	Water surface	440
66.9	Nail in root of red-oak tree, Crafts Ferry, 10 feet west of river	443.67
66.9	Mouth of creek, water surface	427
66.9	Aluminum tablet marked "450 ATLANTA," in rock, 60 feet west of river, 125 feet west of boat landing, Crafts Ferry	448.26
66.9	Foot of Turners Shoals, water surface	427
68.1	Head of Middleton Shoals, water surface	425
68.5	Nail in root of small black-oak tree, 125 feet west of river, opposite Barnes Island	443.11
68.5	Water surface	421
68.7	Nail in root of dogwood tree on top of cliff, 300 feet west of river	457.4
69.5	Nail in root of willow stump, west edge of river	428.6
69.8	Foot of Middleton Shoals, water surface	424
69.8	Nail in root of post-oak tree, 20 feet west of river	432.39
70.2	Nail in root of water-oak tree, 20 feet west of river, Powells Ferry	435.2
70.2	Powells Ferry, water surface	422
70.9	Water surface	419
71.0	Nail in top of white-ash stob 150 feet west of river, 0.8 mile south of Powells Ferry	438.39
71.3	Head of Greggs Shoals, water surface	418.7
72.4	Black Ferry, nail in root of birch tree, 25 feet west of river	421.67
72.4	Black Ferry, water surface	416.3
72.8	Nail in root of octagon burnt tree stump, 350 feet east of river	431.68
73.2	Mouth of creek, water surface	409
73.4	Nail in root of persimmon-tree stump, 350 feet east of river	419.39
73.7	Mouth of branch, water surface	407
73.7	Opposite mill, water surface	406
73.8	Mouth of Clearwater Creek, water surface	406
74.3	Nail in root of persimmon tree, 140 feet southwest of small branch, 350 feet east of river	414.29
75.8	Mouth of Allens Creek, water surface	404
76.2	Harpers Ferry, nail in root of water-oak tree, south side of road, 20 feet east of river	412.25
76.2	Harpers Ferry, water surface	403
76.2	High-water mark	416
76.4	Bronze tablet marked "420 ATLANTA," in limestone rock side of brook, 250 feet southwest of W. J. Taylor house	419.146
77.0	Mouth of branch, water surface	402
77.3	Ruckers and Tuckers Ferry, nail in side of willow tree, 40 feet southeast of and 5 feet west of river	405.49
77.3	Ruckers and Tuckers Ferry, water surface	401
77.3	High-water mark	418
77.6	Water surface	400
78.1	Water surface	399
78.4	Nail in root of white-hickory stump, 50 feet north of river, 60 feet west of English Creek	417.13
78.4	Mouth of English Creek, water surface	398
78.9	Water surface 900 feet south of head of McCauleys Island	397
79.2	McCauleys Ferry, nail in root of ash stump, 40 feet west of river	407.19
79.2	McCauleys Ferry, water surface	397
79.6	Nail in root of beech tree, 150 feet north of river	407.29
79.6	Water surface	396
80.5	Mouth of branch	396
80.8	Nail in root of walnut tree, 50 feet east of river	398.77
81.0	Moseleys Ferry, nail in root of walnut tree, 50 feet east of river	400
81.0	Moseleys Ferry, water surface	392
81.3	Water surface	392
81.6	Water surface	391
81.7	Head of large falls, water surface	390
81.8	Nail in root of twin pine tree, 50 feet east of river	390.23
81.9	Cherokee Shoals, water surface	388
82.6	Water surface	379
82.6	Nail in root of oak tree, 125 feet east of river	385.75

ns on Tugaloo and Savannah rivers from head of Tugaloo River to Augusta—Con.

AH RIVER FROM JUNCTION OF SENECA AND TUGALOO RIVERS TO BROAD RIVER—Continued.

Description of points.	Elevation above sea level.
	Feet.
'ater surface	374
all in root of white-oak tree, 40 feet west of river, Carters Island, ferry	382.52
'ater surface	373
outh of Rocky River, water surface	372
'ater surface	371
ronze tablet marked "383 ATLANTA," abutment, Seaboard Air Line bridge, east side of bridge	382.161
all in root of oak tree, 15 feet north of river, lower end of Watkins Island	375.70
all in side of dead stump, on mainland, 150 feet southwest of Watkins Island	374.59
ead of Trotters Shoals, water surface	367
ioals, water surface	364
ead of island, water surface	362
'ater surface	358
all in stob 75 feet west of river	367.40
nd of Calhouns Island, water surface	356
all in root of black-ash tree, 60 feet southwest of river	365.01
rotters Shoals, water surface	353
'ater surface	351
oint on rock, bottom of cliff	354.27
all in root of triple cedar tree, 75 feet west of river, Calhouns Ferry	348.39
'ater surface	340
'ater surface	336
all in root of pine tree in path, 50 feet southwest of river	341.32
outh of creek, water surface	329.7
'ater surface	328
all in root of Spanish oak, 400 feet west of river, 10 feet southeast of road	338.61
'ater surface	325
all in root of hickory tree in footpath, on top of steep hill, 200 feet west of river	360.67
'ater surface	322
'ater surface	318
ronze tablet marked "320 ATLANTA," in large rock, 50 feet west of river, 2.5 miles southeast of Calhouns Ferry	319.252
'ater surface	313
'ater surface	308
'ater surface	304
all in root of water oak, 300 feet north of old mill, 10 feet west of river	305.90
'ater surface	301
'ater surface	299
outh of branch, water surface	292
all in root of dead birch tree, 10 feet west of river	300.21
'ater surface	291
reek	289
arks Ferry, copper tack in root of water oak, 200 feet west of river	309.13
arks Ferry	287
igh-water mark	307
500 feet below creek, water surface	285
opper tack in side of gum tree, 50 feet west of river	299.66
'ater surface	284
all in root of dead black gum, east side of road, Petersburg Ferry	293.41
outh of Broad River	281
all in root of water oak, south side of ferry road	295.77
ronze tablet marked "328 ATLANTA," in brick wall of R. L. Cade's store, Lisbon	327.850

SAVANNAH RIVER (FROM BROAD RIVER TO AUGUSTA).

'ater surface	279
esters Ferry, 6-inch willow	295.20
esters Ferry, water surface	277
'ater surface	276
welve-inch pine opposite Goat Island	303
'ater surface	276
'ater surface	275
'ater surface	274
outh of branch, water surface	273
'ater surface	272
'ater surface	271
ix-inch willow at Rimsons Ferry	280.59
pposite Murray Island, water surface	270
'ater surface	269
'ater surface	267
'ater surface	267
welve-inch birch, at Barksdales Ferry	281.07
'ater surface	266
en-inch willow, near branch	276.51

Elevations on Tugaloo and Savannah rivers from head of Tugaloo River to Augusta—Con.

SAVANNAH RIVER (FROM BROAD RIVER TO AUGUSTA)—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
108.1	Water surface	26
108.6	Water surface	26
109.1	Water surface	26
109.6	Mouth of small branch	26
110.8	Mouth of small branch	26
112.1	Water surface	26
112.1	Eight-inch cotton tree at Dog Ferry, mouth of Little River (of South Carolina)	26
113.1	Mouth of Hawes Creek	25
114.3	Thirty-inch cotton tree at Ferguson Ferry	26
114.3	Water surface	22
115.1	Head of Point Lookout Shoals	23
115.3	Foot of Point Lookout Shoals	26
115.8	Water surface	24
116.6	Mouth of Landram Creek	24
117.3	Water surface	24
117.6	Twenty-four-inch pine, 50 feet from river, near a rocky hill	22
117.6	Water surface	23
118.4	Water surface	23
118.8	Water surface	23
119.3	Mouth of Jordan Creek	23
120.1	Mouth of small branch	23
121.1	Prices Ferry, 30-inch cotton tree	22
121.1	Prices Ferry, water surface	21
122.1	Water surface	21
122.8	Water surface	20
123.4	Kilcrease Ferry, foot of Long Shoals, 24-inch cotton tree	20
123.4	Kilcrease Ferry, water surface	20
123.8	Water surface	19
124.1	Eighteen-inch cotton tree above old channel way	20
124.8	Mouth of Owl Branch, water surface	19
125.8	Head of Little River Shoals, water surface	19
126.3	Foot of Little River Shoals, water surface	19
126.3	Six-inch willow, mouth of Little River of Georgia	19
126.4	Mouth of Keg Creek, water surface	19
127.1	Bench mark on 8-inch gum below ditch	20
127.6	Head of Scotts Shoals, water surface	18
128.6	Foot of Scotts Shoals, water surface	18
129.6	Lukes Ferry, water surface	17
131.1	Bench mark on 8-inch crooked willow	18
131.1	Water surface	17
131.8	Water surface	17
132.4	Mouth of Big Kiokee Creek, water surface	17
133.4	Mouth of Little Kiokee Creek, water surface	17
134.4	Harveys Falls, water surface	17
135.0	Water surface	17
135.6	Woodlawn, bench mark on beam over last pier of bridge	19
135.6	Woodlawn, water surface	17
136.6	Furys Ferry, on 6-inch pine	18
137.6	Head of Pine Log Shoals, water surface	16
137.8	Foot of Pine Log Shoals, water surface	16
138.6	Water surface	16
139.4	Water surface	16
140.4	Above branch, 10-inch sycamore	17
140.4	Water surface	15
141.6	Ten-inch willow, mouth of Stevens Creek	16
141.6	Water surface	15
142.8	Above dam, water surface	15
142.8	Below dam, water surface	14
142.8	Headwater in canal below locks	15
142.8	Bench mark at locks, top of masonry	16
143.4	Water surface at waste gate	13
143.8	Water surface	13
144.4	Water surface	13
144.6	Headwater in canal	15
144.8	Bench mark on 10-inch pine near canal bank	15
145.1	Headwater in canal	13
145.4	Water surface at waste gate	12
146.1	Water surface	12
146.4	Headwater in canal at city pumping station	15
147.1	Water surface	11
147.6	Warwick Manufacturing Co. tailrace and wastewier, water surface	11
148.4	J. P. King tailrace, water surface	11
149.1	Hawks Gully, water surface	10
149.1	Bench mark marble slab, corner Fifteenth and Broad streets	13
149.1	Zero of gage at Center street, Augusta, Ga	9

SURVEY OF CHATTOOGA RIVER.

The elevations in the following list are based on an aluminum tablet, marked "1050 M. C.," at the Washington street entrance to the State capitol at Atlanta, the elevation of which is accepted as 1,049.546 feet above mean sea level. The initial point upon which these levels depend is a bench mark of primary levels of the Tugaloo and Savannah River survey at the mouth of Chattooga River. The elevations accord with the 1903 adjustment.

The leveling was done for the U. S. Geological Survey in 1903 by Thomas B. O'Hagan, levelman, under the direction of Carroll Caldwell, field assistant.

Elevations on Chattooga River from mouth of Chattooga River to Russell Bridge, Georgia.[a]

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0.0	Tallulah and Chattooga rivers, 100 feet north of junction, point on rock	761.29
0.0	Tallulah and Chattooga rivers, white-oak tree 75 feet west of junction of, 25 feet north of Tallulah River, nail in root of oak tree	762.21
0.0	Tallulah and Chattooga rivers, water surface	754
0.2	Water surface	759
0.7	Mouth of stream, water surface	763
1.0	Worse Creek, mouth of, water surface	765
1.2	Water surface	766
1.9	Small stream on north edge of river, Spanish oak, nail in root of	776.27
1.9	Water surface	772
2.1	Water surface	775
2.6	North side of river, point on rock	788.63
3.0	Water surface	779
4.0	East side of river, point on rock	851.51
4.0	Water surface	849
4.1	Water surface	869
4.5	Mouth of creek, water surface	892
4.7	Water surface	899
4.9	East side of river, point on rock	918.27
4.9	Water surface	919
5.0	Water surface	929
5.1	Water surface	939
5.2	Water surface	949
5.3	Mouth of stream, head of shoals, water surface	954
5.6	Camp Creek, mouth of, water surface	961
5.6	Trail Ford, point on rock 20 feet east of river	967.50
5.6	Trail Ford, water surface	962
5.8	Water surface	969
6.1	Water surface	979
6.3	Water surface	989
6.7	Water surface	999
7.0	Water surface	1,000
7.2	Water surface	1,029
7.4	Cliff Creek, mouth of, water surface	1,035
7.4	Cliff Creek, 300 feet above, east side river, point on rock	1,045.26
7.5	Water surface	1,039
7.6	Chechero Creek, mouth of, water surface	1,049
7.8	Water surface	1,059
8.0	Water surface	1,069
8.2	Water surface	1,079
8.4	Water surface	1,089
8.5	Water surface	1,099
8.6	Water surface	1,109
9.0	Water surface	1,119
9.5	Water surface	1,129
9.8	Water surface	1,149
10.0	East side of river on edge of bank, point on rock	1,152.43
10.0	Water surface	1,159
10.0	Iron bridge, South Carolina side, iron bar under bridge, point on	1,168.95
10.0	Iron bridge, water surface	1,166.3
10.0	High water	1,177
10.5	Water surface	1,169
10.6	Mouth of creek, water surface	1,173

[a] Seven miles north of Russell, S. C.

Elevations on Chattooga River from mouth of Chattooga River to Russell Bridge, Geor
Continued.

Distance.	Description of points.	Elev abov lev
Miles.		*Fe*
10.6	Head of falls, water surface	1,
10.8	Mouth of stream, water surface	1,
11.0	Water surface	1,
11.4	Water surface	1,
11.7	Mouth of stream, water surface	1,
12.0	Water surface	1,
12.5	50 feet south of island, east side of river, 10 feet from bank, point on rock	1,
12.7	Water surface	1,
12.9	Water surface	1,
13.0	Water surface	1,
13.2	Mouth of stream, water surface	1,
13.6	Water surface	1,
13.8	South Carolina side of river, at large cliff, point on rock	1,
14.0	Water surface	1,
14.0	Mouth of Fall Creek, water surface	1,
14.5	Water surface	1,
14.7	Water surface	1,
15.0	Water surface	1,
15.7	Water surface	1,
16.0	Water surface	1,
16.6	Rich Creek, mouth of, water surface	1,
16.8	Water surface	1,
16.9	South Carolina side of river, point on rock	1,
17.0	Water surface	1,
17.4	Water surface	1,
17.8	Sandy bottom, 1,000 feet below, east side of river, point on rock	1,
18.0	Water surface	1,
18.7	Water surface	1,
18.7	East side of river, point on rock	1,
18.9	Water surface	1,
19.1	300 feet below falls, at bend in river, point on rock	1,
19.2	Foot of falls, surface of water	1,
19.0	Head of falls, water surface	1,
19.7	Water surface	1,
19.8	Rock Creek, mouth of, water surface	1,
20.0	Sand ford, water surface	1,
20.0	Sand ford, 75 feet north of, 15 feet east of river, nail in root of white oak tree	1,
20.2	Water surface	1,
20.6	Water surface	1,
20.7	Dick Creek, mouth of, water surface	1,
20.8	Water surface	1,
21.0	East side of river, point on rock	1,
21.2	Water surface	1,
22.0	Water surface	1,
22.1	Water surface	1,
22.3	4 feet east of river, nail in root of pine tree	1,
22.7	Water surface	1,
23.0	Earl Ford, 100 feet below ford, east side of river, point on rock	1,
23.0	Earl Ford, water surface	1,
23.0	Warwoman Creek, mouth of, water surface	1,
23.8	South side of river, point on rock	1,
23.8	Water surface	1,
24.8	Water surface	1,
25.2	West side of river, point on rock	1,
25.2	Water surface	1,
26.0	Horseback Ford, water surface	1,
26.3	Water surface	1,
26.4	Ford, 65 feet above, north side of river, nail in live stob (white-oak tree)	1,
26.4	Water surface	1,
26.8	Water surface	1,
27.1	Water surface	1,
27.9	Barlow stream, center of river, point on rock	1
28.0	Water surface	1
28.7	Long Bottom Ford, east side, nail in fork of sugar-maple tree	1
29.7	Small stream, mouth of river at, water surface	1
30.6	West fork, mouth of, water surface	1
30.6	Wooden bridge above Russell, S. C., southwest side of bridge, point on bolt	1
30.6	Bridge, water surface	1

SURVEY OF BROAD RIVER.

elevations in the following list are based on a bronze tablet in
: wall of R. L. Cade's store at Lisbon, Ga., marked "ATLANTA
:he elevation of which is accepted as 327.850 feet above mean
el in accord with the 1903 adjustment of the precise level net.
leveling was done in 1903 for the United States Geological
' by Thomas B. O'Hagan, levelman, under the direction of
Caldwell, field assistant.

:vations on Broad River from mouth to Harrison Bridge, near Carnesville.

Description of points.	Elevation above sea level.
	Feet.
isbon, mouth of Broad River, 870 feet northwest of, south side of ferry road, nail in twin water oak	295.77
road River, mouth, water surface	280
road River, 870 feet northwest of mouth, high-water bench mark	300
mall stream near, water surface	281
ill Ford Shoals, foot of, water surface	281
ill Ford Shoals, middle of, water surface	288
ill Ford Shoals, head of, water surface	289
ill Ford Shoals, 200 feet east of river near 5-inch elm tree, nail in line stob	304.9
nter of bend, water surface	391
De Bose Ferry, 300 feet above, water surface	392
nthony Shoals, foot of, water surface	293
nthony Shoals, water surface	295
nthony Shoals, at large bend in river, surface of water	307
nthony Shoals, at rock cliff, water surface	310
nthony Shoals, at rock cliff, point on rock 1 foot west of river	311.57
nthony Shoals, water surface	319
nthony Shoals, water surface	329
nthony Shoals, in front of factory, water surface	339
nthony Shoals, at dam, east edge of river, nail in root of birch tree	347.77
nthony Shoals, at dam, water surface	351
nthony Shoals, head of, water surface	355
urton Ferry, 6 feet south of river, nail in root of Spanish-oak tree	361.44
urton Ferry, water surface	355
urton Ferry, high water	364
'ater surface	355
outh of creek, water surface	356
feet south of river, 25 feet east of creek, nail in sweet-gum tree	367.59
'ater surface	356
akers Ferry, small shoals, water surface	356
akers Ferry, 20 feet southwest of river, nail in root of large birch tree	364
akers Ferry, water surface	357
'ahache Creek, mouth of, water surface	360
ells Bridge, north side, nail in joist	375.69
ells Bridge, water surface	360
ells Bridge, high water	386
ells Bridge, floor of	393.2
ells Bridge, 250 feet north of river, large pine tree near path to river, nail in tree	375.34
outh of small stream, water surface	361
alling Creek, mouth of, water surface	362
ot of shoals, water surface	363
ish dam, foot of, water surface	365
ish dam, head of, water surface	368
ish Dam Ferry, north side of river, nail in root of large water-oak tree	374.35
ish Dam Ferry, south side of, nail in root of gum tree	374.87
ish Dam Ferry, water surface	368
'ater surface	368
orth of river, point on rock	386.66
'ater surface	370
rimes Old Ferry, edge of river, nail in root of white-oak tree	375.51
rimes Old Ferry, water surface	371
0 feet south of river, 25 feet south of river road, nail in root of Spanish oak	398.89
outh of large creek, water surface	372.8
ine grove, 400 feet north of river, 900 feet west of large creek, nail in root of pine tree	368.51
attox Bridge, north side, nail in plank	401.35
attox Bridge, floor	404
attox Bridge, water surface	374
attox Bridge, high water	400
ock cliff, near, 40 feet south of river, nail in root of gum tree	397.88
ater surface	377

Elevations on Broad River from mouth to Harrison Bridge, near Carnesville—Co

Distance.	Description of points.	El abo
Miles.		F
25.2	Jones Ferry, east side, nail in root of water-oak tree	
25.2	Jones Ferry, water surface	
25.2	Jones Ferry, high-water mark	
25.5	Jones Ferry, 0.3 mile above, 40 feet west of river, nail in white-oak tree	
26.0	Surface of water	
26.7	Millstone Creek, mouth of, 60 feet east of, 5 fe t south of river, nail in side of elder	
26.7	Millstone Creek, water surface	
28.0	Gold Mine Cliff, water surface	
28.5	Horseshoe bend, head of, 150 feet south of river, in cornfield, nail in Spanish oak	
28.5	Dove Creek, mouth of, water surface	
28.6	Bend in river, water surface	
28.6	Water surface	
30.0	200 feet north of river, nail in root of pine tree	
30.9	Water surface	
31.0	Martin Old Ferry, near spring, point on rock	
31.3	Junction South Fork and Broad River, southwest point of rivers, nail inside of birch tree	
31.3	Water surface	
32.4	Detweiler Ferry, foot of shoals, water surface	
32.9	Detweiler Ferry, east side, edge of water, slanting Spanish oak, nail in	
32.9	Detweiler Ferry, head of shoals, water surface	
32.9	Detweiler Ferry, high water	
33.4	Seaboard Air Line bridge, abutment, east side of river, 350 feet from	
33.4	Seaboard Air Line bridge, water surface	
34.0	Moores Shoals, water surface	
34.4	Old Mill, 25 feet east of river, point on rock	
34.4	Old Mill, mouth of stream, water surface	
34.4	Moores Shoals, head of, water surface	
34.7	Bells Ferry, edge of river, 2 feet from road overhanging Spanish oak	
34.7	Bells Ferry, water surface	
34.7	Bells Ferry, high water	
35.9	Harpers Ferry, north side of river, east side ferry, nail in root of black-gum tree	
35.9	Harpers Ferry, water surface	
35.9	Harpers Ferry, high water	
36.8	Holly Branch, mouth of, water surface	
37.5	Moons Ferry, east of ferry, nail in side of white-oak tree	
37.5	Moons Ferry, water surface	
37.8	Water surface	
37.9	Mouth of creek, water surface	
38.6	Payton Shoals, foot of, water surface	
39.0	Payton Shoals, east side of river, nail in sycamore tree	
39.0	Payton Shoals, head of, water surface	
39.0	South Payton Ferry, 25 feet from river, east side of ferry, nail in side of dead willow tree	
39.1	Payton Ferry, water surface	
39.1	Payton Ferry, high water	
39.4	Payton Ferry, No. 2, head of shoals, water surface	
39.8	Victory Ferry, overhanging birch tree, nail in side of	
39.8	Victory Ferry, water surface	
39.8	Victory Ferry, high water	
40.4	Moons Ferry, nail in root of white-oak tree	
40.4	Moons Ferry, foot of shoals, water surface	
40.5	Moons Shoals, head of, water surface	
41.1	Bend in river, 1,500 feet east of Mill Creek, east side of river, point on rock	
41.1	Water surface	
41.4	Mill Shoal Creek, mouth of, water surface	
41.4	Water surface	
42.2	Head of shoals, water surface	
42.7	Moores Ferry, west side of, large spruce tree, nail	
42.7	Moores Ferry, water surface	
42.7	Moores Ferry, high-water mark	
43.0	Moores Shoals, at spring, foot of shoal, surface of water	
43.3	Shoals, water surface	
43.3	Moores Shoals, point on rock	
43.8	Browns Ferry, burnt stump northeast of river, nail in	
43.8	Browns Ferry, near head of Moores Shoals, water surface	
44.2	Moores Shoals, head of, water surface	
44.6	Dudleys Shoal, east bank of river, point on rock	
44.6	Dudleys Shoal, water surface	
45.5	Dudley Ferry, black-gum tree, north side of ferry, nail in root	
45.5	Dudley Ferry, water surface	
45.5	Dudley Ferry, high-water mark	
45.6	Bryant Shoals, foot of, water surface	
46.2	Bryant Shoals, head of, water surface	
46.5	Sawmill, Spanish-oak tree, 50 feet from river, nail in root of	
46.5	Water surface	
46.5	Head of shoals, water surface	
47.7	North side of river, 1.2 miles below Blue Creek, point on rock	
47.7	Water surface	
48.9	Mouth of Blue Creek, water surface	

m Broad River from mouth to Harrison Bridge, near Carnesville—Continued.

Description of points.	Elevation above sea level.
	Feet.
r surface	521
bridge, east side of river, nail in floor of	546.44
e floor	548.8
r surface	523
water mark	548.1
h of stream, foot of shoals, water surface	523.7
of shoals, water surface	526
ers Creek, just below bend in river, water surface	545
ers Creek, mouth of, head of shoals, water surface	529
r surface	532
h of stream, water surface	535
gs Ferry, 2 feet from river, nail in root of large red-oak tree	541.75
gs Ferry, mouth of Hudson River, water surface	537
r surface	541
Bridge, southeast corner of, nail in side of white-oak tree	561.78
Bridge, water surface	542
Bridge, high water mark	560
of shoals, water surface	548
of shoals, water surface	552
r surface	554
, 60 feet southeast of mouth of, nail in white-oak tree	563.30
h of creek, water surface	556
h of stream, water surface	556
e Broad and Broad rivers, fork of, walnut tree, 75 ft. west of fork, nail in side	575.16
r surface	557
le bridge, northwest side of, nail in plank	581.11
r surface	563
water mark	576
e floor	584
of shoals, water surface	570
r surface	573
Creek, 6 miles below, large rock projecting out from bank, point on	581.02
shoal in river	580
Creek, mouth of	581
on east side of river, point on rock	591.15
r surface	584
lam, water surface	586
r surface	588
in river, east side, point on rock cliff	598.50
Shoal, head of	591
ns Creek, mouth of	592
oak tree, 75 feet north of, nail in north side of	603.49
r surface	593
r surface	594
sons Bridge, east of, north of river, nail in root of Spanish oak	607.07
e floor	613.7
r surface	596
water mark	612

ER POWER IN SAVANNAH RIVER DRAINAGE BASIN.

GENERAL STATEMENT.

tended that the foregoing lists of water surface elevations main river and tributaries above Augusta shall give full lete data in regard to the total fall and its distribution on ams:

ord of the hydrographic stations at Augusta, Ga., Calhoun ., and Fort Madison, S. C., on Savannah and Tugaloo rivers, n Broad River, and Tallulah Falls on Tallulah River will sis for estimating the amount of water flowing at all points. following, attention is called to certain important shoals and grouping of shoals into proposed powers, and mention is some of the conditions relative to developing these powers, to powers already utilized.

TALLULAH RIVER.

From the mouth of Popcorn Creek, near the headwaters, down to mouth of Tiger Creek, a distance of 25 miles, the fall is 265 feet, and as can be seen from the list of elevations is almost uniformly distributed, being slightly more than 10 feet to the mile. At a few points in the section the drop is from 5 to 10 feet in a short distance, and good small-power sites are available. In the next 4 miles below Tiger Creek the fall is 55 feet. This reaches the head of the rapids above Tallulah Falls, at which point there is an excellent location for a large storage dam. The fall from here down to the head of Tallulah Falls proper is 110 feet. Somewhere in this section the water should be diverted to a canal if the falls proper should ever be developed into water power, as by beginning the canal at high enough elevation it can be put on comparatively good ground outside the gorge. A large water power can be developed in this section entirely above the falls proper at a comparatively small expense. Along Tallulah River, beginning at Tallulah Falls, is some of the most picturesque and rugged scenery in the Southern States. In 3½ miles the river drops from 1,414 to 754 feet above sea level, or a distance of 660 feet. The principal falls, in the order they occur, are L'eau D'or 28 feet, Tempesta 76 feet, Hurricane 89 feet, Oceana 41 feet, Bridal Veil 17 feet, all occurring within a distance of less than three-fourths of a mile. The gorge is very difficult and dangerous to climb. On both banks are precipitous cliffs, rising in some places 500 feet shear. The gorge continues to the Tugaloo, except for one stretch about one-half mile long, where it opens up and forms what is known as the Old Valley farm. In the 2½ miles above the mouth of the river there is a fall of 254 feet, all below the falls proper, which could be used for power without interfering with Tallulah Falls.

WATER POWER ON TUGALOO RIVER.

From the head of Tugaloo River down to the mouth of Panther Creek, a distance of 4½ miles, there are some good shoals, the total fall being 85 feet. The banks are favorable for power development along the entire stretch. From Panther Creek to Averys Ferry, a distance of 35 miles, the slope is too gentle and the valley too wide to utilize the river without flooding considerable farming land. Chandler Shoals, 1½ miles below Averys Ferry, begin near Bradberry Ferry and have a fall of 10 feet in three-fourths mile. Three-fourths of a mile below are Hatten Shoals, with a fall of 35 feet in 2 miles. These shoals are considered the finest on the river; a 45-foot dam at them would back the water about 4 miles, with very little damage to cultivated land. From this point down to the mouth of Seneca River, which is the head of Savannah River, the fall is 14 feet in a distance of 4 miles.

WATER POWER ON SAVANNAH RIVER.

The fall in Savannah River for the first 7 miles, down to the head of McDaniels Shoals, is 20 feet. At McDaniels Shoals there is a fall of 19 feet in 3 miles. Half a mile above the foot of the shoals, at the head of Harpers Island, is an excellent site for a dam about 700 feet long.

In the 4 miles between this power and the next at Turners Shoals the fall is 12 feet. At Turners Shoals there is a fall of 17 feet in about 4½ miles. These shoals begin at Kenly Ferry and extend to Crafts Ferry. The river widens considerably about a mile below Kenly Ferry. There are several good sites for dams, one being on Crafts Island. The river is wide, however, requiring a dam about 1,000 feet long.

Half a mile below, at Middleton Shoals, there is a fall of 11 feet in 1¾ miles, with an excellent site for a dam at the foot of the shoals. In 1½ miles below, the fall is 5 feet. This reaches the head of Gregg Shoals, where the fall is 8 feet in about a mile. Here the river runs between steep hills, and a dam would be about 900 feet long.

Half a mile below Moseleys Ferry are the Cherokee Shoals, having 19 feet fall in 2½ miles. This is a very fine power site, as the river runs between steep hills. A dam would have to be 1,000 feet long, and would be placed about a quarter of a mile above the Seaboard Air Line railroad bridge.

One and a quarter miles below the bridge are Trotters Shoals, with a fall of 75 feet in 6 miles. These are considered the finest shoals on the river. They commence at the foot of Watkins Island and extend below Tate's mill to Coffer Creek. In this distance there are numerous rocky bluffs where there are excellent dam sites.

In the next 5 miles, extending to the mouth of Broad River, the fall is 11 feet. From the mouth of Broad River down to Little River, from the South Carolina side, the fall is slight, being 23 feet in the distance of 16 miles. From this point down to the upper end of Long Shoals the fall is 42 feet in 6 miles.

The fall is 23 feet in the next 5 miles, extending to the foot of Scotts Shoals. From here to the Augusta dam the fall is 28 feet in 15 miles.

At Augusta the power is fully developed by a dam about 10 feet high and a canal 7 miles long. The head is about 50 feet. This power belongs to the city of Augusta. It was developed in 1845–1847 and the canal was enlarged in 1872–1875.

WATER POWER ON CHATTOOGA RIVER.

Tallulah River unites with Chattooga River to form the Tugaloo. Chattooga River contains many available undeveloped power sites. From its mouth to Warwoman Creek, a distance of 23 miles, the river

flows through a wild, rugged country, being in a gorge almost the entire distance, which results in a very narrow and swift stream. There are numerous dam sites along this distance, the river being almost one continuous shoal, averaging a fall of 32 feet to the mile, and having a fine rock bottom, with rock cliffs on either side. From Warwoman Creek up to Russells Bridge the valley is wide and the fall is much less, being 78 feet in 7 miles.

WATER POWER ON BROAD RIVER.

In the 4¾ miles from the mouth of the river to foot of Anthony Shoals the fall is 13 feet, 8 feet of which occurs in a distance of 1 mile at Millford Shoals.

Anthony Shoals is the finest power site on the river and is one of the best in the State, the fall being 62 feet in a distance of 1¾ miles. Several plans have been proposed for developing the power. Probably the best plan is to build a dam near the upper end of the shoal high enough to raise the water at least 10 feet, and to construct a canal to a point near the foot of the shoals. The proposed raise of 10 feet would back the water 10 miles up the river to the foot of Fish dam, where there is a 3-foot dam, 250 feet long, furnishing power for a gristmill and a sawmill. From Fish dam to the mouth of South Broad River, 15 miles, there is a fall of 23 feet, with no shoal of any consequence. The bottoms are wide in most places and are in a high state of cultivation.

One mile above the mouth of South Broad River are the Detweiler Shoals, with a fall of 7 feet in one-half mile. A mile and a half farther are the Lower Moore Shoals, with a fall of 7 feet in one-third mile, with good outcrops of hard rock on both sides. A dam here would be about 350 feet long.

Five miles farther up the river are Payton Shoals with a fall of 3 feet in one-third mile. In the 4 miles from Payton Shoals to the foot of Moores Shoals the fall is 29 feet. At Moores Shoals there is a fall of 28 feet in 1¼ miles. Above this point there are several shoals with good sites for dams. The fall is 35 feet for the first 5 miles up to the mouth of Blue Creek, and about 5 feet to the mile above this to the end of the survey at Harrison Bridge.

OGEECHEE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Ogeechee River is formed by the junction of Williamsons Swamp Creek and Rocky Comfort Creek in Jefferson County, Ga., and drains a small basin in southeastern Georgia lying between the Savannah and Altamaha basins. Ogeechee River runs in a southeasterly direction and empties into the Atlantic Ocean. Its main tributary is Cannoochee

River, which rises in Emanuel County, Ga., and flows southeast, joining the Ogeechee about 20 miles from the Atlantic Ocean. The streams in this basin run through a country that is mostly low. The current is generally good, but the fall available for power is probably small. The bank on one side or the other of the stream is generally low and swampy.

STREAM FLOW.

OGEECHEE RIVER NEAR MILLEN.

This station was established by F. A. Murray at Daniel's toll bridge, 1 mile west of Millen, on June 20, 1903, but was discontinued December 31, 1903, on account of poor conditions for accurate measurement of the flow.

The channel is straight for about 300 feet above and about 500 feet below the bridge. The current is swift in the main channel and sluggish near the banks. The right bank is low and overflows. There is a trestle approach for about 300 feet over low, swampy land on this side of the river. The left bank is lower than the right bank, the swamp extending back from the river about one-fourth mile. The bed of the stream is sandy and shifting. There is but one channel at ordinary stages, but several channels at high water.

Discharge measurements were made from the upstream side of the wooden highway bridge to which the gage is attached. The bridge is at an angle of about 45° to the current. The initial point for soundings is the end of the hand rail at the tollhouse on the left bank, upstream side of the bridge.

The gage is a vertical rod reading from 0 to 12 feet. It is nailed to the upstream post of the third bent from the tollhouse. The gage was read once daily during 1903 by T. J. Lane, the toll keeper.

Bench mark No. 1 is the top of the upstream end of the cap of the first bent from the tollhouse; elevation, 12.00 feet above the zero of the gage. Bench mark No. 2 consists of a notch and nails in the corner of the tollhouse next the river; elevation, 18.00 feet above the zero of the gage.

Discharge measurements of Ogeechee River near Millen in 1903.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*	1903.	*Feet.*	*Sec.-ft.*
June 20	5.06	1,548	October 10	2.09	519
July 30	2.35	515	November 20	4.00	889
October 10	2.08	470			

Daily gage height, in feet, of Ogeechee River near Millen.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	I
1903.							
1		6.0	2.3	2.4	2.5	2.6	
2		5.7	2.4	2.3	2.4	2.6	
3		5.5	2.7	2.3	2.3	2.7	
4		5.3	3.0	2.3	2.2	2.9	
5		5.3	3.1	2.2	2.1	3.0	
6		5.3	3.4	2.2	2.0	3.2	
7		5.2	3.8	2.1	2.0	3.5	
8		5.0	4.2	2.0	2.0	3.8	
9		5.4	4.1	1.9	2.0	4.0	
10		5.8	3.9	1.9	2.1	4.2	
11	6.5	5.5	3.6	1.8	2.1	4.5	
12	7.1	5.7	3.3	1.7	2.1	4.6	
13	6.9	6.2	3.1	1.5	2.1	4.7	
14	6.7	6.4	3.0	1.6	2.1	4.8	
15	6.6	6.4	3.3	1.9	2.2	4.7	
16	6.5	6.3	3.5	4.1	2.2	4.5	
17	6.2	6.4	3.9	4.9	2.2	4.3	
18	5.9	6.3	4.0	5.5	2.3	4.1	
19	5.5	6.0	4.2	5.6	2.8	4.0	
20	5.2	5.7	4.8	5.4	3.4	4.0	
21	5.0	5.4	5.7	5.1	3.8	4.0	
22	4.8	5.0	6.0	4.9	4.0	4.0	
23	4.8	4.6	5.9	4.8	4.0	4.0	
24	4.9	4.0	5.7	4.7	4.0	4.0	
25	4.8	3.6	5.5	4.5	4.0	4.0	
26	4.6	3.3	5.3	4.1	4.0	4.0	
27	4.7	3.0	5.1	3.5	3.8	4.0	
28	5.1	2.8	4.8	3.0	3.4	4.0	
29	5.5	2.6	4.0	2.7	3.0	4.1	
30	5.8	2.5	3.3	2.6	2.8	4.1	
31		2.3	2.6		2.6		

Rating table for Ogeechee River near Millen from June 11 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	418	2.80	595	4.10	933	5.40	1,860
1.60	428	2.90	611	4.20	980	5.50	1,900
1.70	440	3.00	628	4.30	1,030	5.60	2,065
1.80	452	3.10	646	4.40	1,085	5.70	2,170
1.90	465	3.20	665	4.50	1,145	5.80	2,275
2.00	478	3.30	685	4.60	1,210	6.00	2,490
2.10	492	3.40	707	4.70	1,275	6.20	2,710
2.20	506	3.50	731	4.80	1,345	6.40	2,930
2.30	520	3.60	757	4.90	1,420	6.60	3,150
2.40	534	3.70	785	5.00	1,500	6.80	3,370
2.50	549	3.80	816	5.10	1,585	7.00	3,590
2.60	564	3.90	850	5.20	1,675		
2.70	579	4.00	889	5.30	1,765		

Estimated monthly discharge of Ogeechee River near Millen.

Month.	Discharge in second-fee		M
	Maximum.	Minimum.	
1903.			
June 11–30	3,700	1,210	
July	2,930	520	
August	2,490	520	
September	2,065	418	
October	889	478	
November	1,345	564	
December	1,960	785	

WILLIAMSONS SWAMP CREEK AT DAVISBORO.

This station was established June 19, 1903, by F. A. Murray, at the Davisboro Bridge, about 200 yards south of the Central of Georgia Railroad station, which is in the middle of the town. It was discontinued on December 31, 1904.

The channel is straight for about 200 feet above and below the station. The right bank is low and overflows at a gage reading of 4 to 4½ feet. The left bank will overflow at a gage height of 3 feet. The bed of the stream is sandy and is slightly shifting. There is but one channel at all stages. The current is somewhat obstructed by the piers which support the bridge at low water and by trees and brush on the banks at high water. Discharge measurements were made from the upstream side of the wooden highway bridge, which is supported by wooden bents about 18 feet apart. The initial point for soundings is the outer edge of the post which supports the end of the hand rail on the left bank upstream side of the bridge. The gage is a vertical rod 10 feet long. It is nailed to the left side of the upstream post of the bent which supports the bridge at a point 302 feet from the initial point for soundings. It was read once each day by A. Baker, a hotel proprietor, who was paid by the Georgia Geological Survey.

Bench mark No. 1 is the top of the bridge floor at the bent 302 feet from the initial point for soundings on the upstream side of the bridge. The point is marked with a cross and the letters "B. M." cut into the top of the bridge-floor plank; elevation, 11.00 feet above the zero of the gage, which is attached to the same bent. Bench mark No. 2 is the center of a large wire nail driven horizontally into the bridgeward side of an ash tree which stands in the creek near the right bank about 40 feet below the bridge; elevation, 5.50 feet above the zero of the gage.

Discharge measurements of Williamsons Swamp Creek at Davisboro.

Date.	Gage height	Discharge.	Date.	Gage height	Discharge.
1903.	*Feet.*	*Sec.-ft.*	1903.	*Feet.*	*Sec.-ft.*
June 19	2.41	83	October 13	1.72	47
July 18	2.58	100	October 13	1.64	41
July 29	1.64	46	November 21	2.58	94
July 29[a]	1.64	45	December 28	2.69	97

[a] Wading 50 feet below bridge.

Daily gage height, in feet, of Williamsons Swamp Creek at Davisboro.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	De
1903.												
1							2.5	2.1	1.8	1.7	2.1	2
2							2.3	4.0	1.9	1.8	2.2	1
3							3.3	2.4	1.7	1.8	2.1	1
4							3.7	3.5	1.7	1.7	2.4	2
5							2.3	3.0	1.7	1.5	4.4	2
6							2.3	2.4	1.8	1.6	3.2	2
7							5.8	2.1	1.7	1.6	2.9	2
8							5.0	2.0	1.7	2.0	2.5	1
9							3.5	1.8	1.7	2.0	2.4	1
10							3.9	1.9	1.7	2.0	2.4	2
11							3.2	2.1	1.7	1.9	2.5	2
12							4.3	2.3	1.7	1.8	2.4	2
13							3.6	2.3	1.8	1.7	2.6	2
14							5.1	2.2	1.9	1.7	2.6	2
15							4.7	2.1	3.0	1.7	2.5	2
16							3.4	2.1	4.0	1.8	2.5	2
17							2.8	2.3	3.0	2.9	2.5	1
18							2.6	2.1	2.8	4.0	2.5	2
19						2.4	2.5	3.0	2.5	2.4	2.7	2
20						2.5	2.5	3.8	1.9	2.1	2.5	2
21						2.5	2.3	3.6	1.8	2.2	2.6	2
22						2.6	2.1	3.2	2.0	2.2	2.6	1
23						2.4	2.1	2.1	1.9	2.1	2.5	2
24						2.3	2.1	2.0	2.0	2.0	2.5	2
25						2.2	2.3	2.1	1.9	2.1	2.4	2
26						2.2	2.3	1.9	1.9	2.0	2.4	2
27						2.2	1.9	1.8	2.0	2.0	2.5	1
28						4.4	1.8	1.8	1.9	2.0	2.5	1
29						4.0	1.7	1.7	1.8	2.1	2.5	1
30						2.9	1.8	1.7	1.8	2.1	2.4	1
31							1.8	1.8		2.2		
1904.												
1	2.7	2.8	2.8	2.5	1.8	3.1	2.2	4.6	2.2	1.65	1.4	
2	2.6	2.9	2.7	2.7	1.8	3.1	1.3	4.6	2.1	1.5	1.4	
3	2.5	2.6	2.6	2.4	1.85	2.3	1.4	2.3	2.0	1.5	2.0	
4	2.4	2.5	3.4	2.25	1.9	1.9	1.3	1.8	2.0	1.8	2.9	
5	2.5	2.6	3.2	2.3	1.55	1.45	1.3	3.8	2.05	1.7	2.9	
6	2.5	2.6	3.1	2.4	1.3	1.4	1.3	3.6	2.05	1.6	2.4	
7	2.5	3.2	4.1	2.45	1.8	1.3	1.3	3.8	2.1	1.6	2.2	
8	2.5	3.1	3.6	2.2	1.9	3.4	1.35	3.85	2.0	1.7	2.1	
9	2.5	3.3	3.4	2.9	1.8	2.0	1.35	5.35	2.0	1.6	2.0	
10	2.5	4.2	3.2	2.7	1.8	1.6	2.7	5.5	2.0	1.45	1.9	
11	2.7	5.1	3.1	2.6	1.8	1.6	2.0	4.0	2.0	1.5	1.8	
12	2.8	5.8	3.1	2.3	1.65	1.6	1.7	2.8	2.0	1.5	1.8	
13	2.6	3.5	2.8	2.25	1.55	1.5	1.5	2.6	2.0	1.4	3.2	
14	2.6	3.7	2.7	2.3	1.45	1.5	1.4	2.4	1.95	1.5	3.6	
15	2.9	3.5	3.2	2.25	1.65	1.5	1.5	2.4	1.9	1.5	3.0	
16	2.7	3.5	2.8	2.2	1.6	1.4	1.35	2.2	1.85	1.5	2.1	
17	2.6	3.3	2.5	2.1	1.5	1.4	1.3	2.05	1.8	1.4	2.2	
18	2.5	3.1	2.4	2.0	1.5	1.4	1.8	2.0	1.8	1.5	2.0	
19	2.6	3.1	2.7	2.1	1.45	1.35	1.6	1.9	1.8	1.5	2.0	
20	2.7	3.1	2.6	2.1	1.4	1.3	1.5	1.8	1.8	1.4	2.0	
21	2.8	3.7	2.9	2.05	1.4	1.3	1.2	1.8	1.7	1.6	2.0	
22	2.9	4.0	2.6	2.0	1.4	1.4	1.4	1.8	1.7	1.5	2.0	
23	4.2	3.7	2.6	2.0	1.25	1.25	1.5	1.9	1.75	1.4	2.6	
24	3.9	3.3	2.6	2.0	1.6	1.2	1.85	1.8	1.8	1.4	2.8	
25	3.0	3.0	3.0	1.9	1.3	1.2	1.45	1.8	1.8	1.4	2.8	
26	2.8	3.1	2.9	2.0	1.25	1.2	2.5	1.7	1.8	1.7	2.6	
27	2.8	3.1	3.4	2.0	1.25	1.2	1.8	5.1	1.7	1.5	2.3	
28	3.0	3.0	3.3	2.0	1.25	1.1	1.6	5.0	1.8	1.4	2.2	
29	3.0	2.9	2.5	1.95	1.3	1.5	2.5	3.6	1.6	1.4	2.2	
30	2.9		2.5	1.9	1.6	1.55	2.25	2.5	1.6	1.4	2.4	
31	2.9		2.6		3.0		2.1	2.3		1.4		

ing table for Williamsons Swamp Creek at Davisboro, from June 19 to December 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-feet.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	40	2.60	95	3.70	175	4.80	270
1.60	44	2.70	101	3.80	183	4.90	279
1.70	48	2.80	108	3.90	191	5.00	288
1.80	52	2.90	115	4.00	199	5.10	297
1.90	57	3.00	122	4.10	207	5.20	306
2.00	62	3.10	129	4.20	216	5.30	315
2.10	67	3.20	136	4.30	225	5.40	324
2.20	72	3.30	143	4.40	234	5.50	334
2.30	77	3.40	151	4.50	243	5.60	344
2.40	83	3.50	159	4.60	252	5.70	354
2.50	89	3.60	167	4.70	261	5.80	364

[a] This rating table can not be applied to the 1904 gage heights, owing to the shifting character of the am bed.

Estimated monthly discharge of Williamsons Swamp Creek at Davisboro.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1903.			
19–30	234	72	107
	364	48	127
ust	199	48	85
ember	199	48	66
ber	199	40	65
ember	234	67	94
mber	183	72	97

CANNOOCHEE RIVER NEAR GROVELAND.

This station was established June 12, 1903, by F. A. Murray, at ody's bridge, 3 miles south of Groveland, Bryan County.

The channel is straight for about 300 feet above and 400 feet below station. The current is swift in the main channel, but sluggish ar the banks. Both banks are of clay and sand, and overflow at m 15 to 16 feet gage height. The bed of the stream is of silt, and is fting. There is but one channel at all stages, broken by the piers the bridge, up to the height at which the river overflows its banks. Discharge measurements are made from the downstream side of the ıe-span wooden highway bridge. The initial point for soundings is outer edge of the post which supports the end of the hand rail on downstream side of the bridge on the left bank.

The original gage, reading from 0 to 17 feet, is nailed to the right e of the upstream post of the fourth bent from the left bank. From to 20 feet the post is graduated to feet and half feet. A new gage, ıding from 0 to 10 feet, is fastened to the left-bank side of the stream post of the third bent from the left bank, this being the first nt in the water at ordinary stages. Another section of the gage, ıding from 5 to 10 feet, is fastened to a gum tree on the left bank 25 t above the bridge. This gage faces the bridge, and is used for the

stages which it covers. The gage is read once each day by J. E Edwards. Bench marks were established as follows: (1) The top the bridge floor at the fourth bent from the left end of the bridge the upstream side opposite a point 61 feet from the initial point f soundings, marked by a cross and the letters "B. M." cut in the flo elevation, 20.00 feet. (2) Two large wire nails driven into the tree which the third section of the gage is fastened; elevation, 5.30 fe Two more nails are also driven at the 8-foot mark.

Discharge measurements of Cannoochee River near Groveland.

Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*
June 12	12.90	3,467
June 24	5.20	734
July 11	9.97	2,224
July 11	9.92	2,562
August 21	15.11	4,125
September 9	4.45	462
November 18	5.05	734
December 29	6.20	1,014
1904.		
February 20	9.45	2,075
July 22	1.53	27
July 22 [a]	1.61	30
September 12	4.16	438
September 12	4.16	
October 29 [a]	1.54	
October 29 [a]	1.54	
November 29	2.27	
November 30	2.30	
1905.		
April 26	6.17	
April 26	6.14	
June 12	1.60	
July 27	2.51	
July 27 [b]	2.50	
November 7 [b]	1.25	
November 7 [b]	1.26	

[a] Wading 1,000 feet below bridge.

[b] Made at different section.

Daily gage height, in feet, of Cannoochee River near Groveland.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	D
1903.												
1							9.8	2.6	5.5	5.7	3.8	
2							8.0	2.6	5.1	5.4	3.9	
3							6.9	2.6	5.0	5.3	5.4	
4							6.4	2.7	4.5	5.1	6.2	
5							6.1	3.2	4.8	4.8	6.7	
6							6.3	4.3	4.9	4.7	6.9	
7							5.9	6.0	4.6	4.6	6.6	
8							5.4	6.7	4.2	4.6	6.2	
9							5.9	6.7	4.0	4.5	5.9	
10							6.8	5.5	3.8	4.3	5.6	
11							8.7	4.9	3.7	4.2	5.2	
12							10.6	4.5	3.6	4.0	5.0	
13							9.7	4.9	3.7	3.9	4.8	
14							9.5	7.2	3.8	3.8	4.7	
15							9.2	8.1	7.0	3.8	4.7	
16							9.5	10.1	13.8	3.7	4.5	
17							10.0	11.1	17.8	3.7	4.5	
18							9.5	17.2	18.0	5.7	5.0	
19							8.9	16.7	17.3	7.9	5.0	
20							8.2	16.0	16.5	8.8	4.6	
21							5.5	15.2	15.7	9.4	4.5	
22							5.2	15.0	14.7	8.9	4.4	
23						5.2	4.9	16.0	13.2	7.9	4.2	
24						5.7	3.7	15.8	11.3	6.6	4.0	
25						5.6	3.5	15.1	9.6	6.0	4.0	
26						5.7	3.3	13.8	8.2	5.4	4.1	
27						5.2	3.3	12.0	7.3	4.7	4.5	
28						6.5	3.2	10.4	6.6	4.4	4.6	
29						8.1	3.0	8.5	6.3	4.2	4.5	
30						9.0	2.9	7.0	6.1	4.0	4.3	
31							2.7	6.0		3.9		

Daily gage height, in feet, of Cannoochee River near Groveland—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
1	7.2	9.3	9.6	5.9	2.4	2.0	1.7	4.5	6.2	2.1	1.5	2.2
2	7.6	8.5	9.1	5.7	2.4	2.0	1.7	4.6	6.4	2.0	1.5	2.2
3	7.6	8.2	8.2	5.2	2.3	2.0	1.7	5.9	6.2	1.9	1.6	2.1
4	6.9	7.6	8.0	4.7	2.2	2.0	1.7	4.9	4.8	1.9	1.8	2.2
5	6.5	7.0	7.6	4.3	2.2	2.0	1.6	5.9	4.1	1.9	2.1	2.4
6	6.1	6.8	7.6	4.2	2.1	2.0	1.6	8.0	3.8	1.8	2.1	2.4
7	5.7	6.6	7.6	4.0	2.1	1.9	1.6	10.8	5.0	1.8	2.0	2.7
8	5.3	6.2	8.0	4.0	2.1	1.9	1.6	13.2	6.8	1.7	2.0	2.8
9	5.2	6.3	8.0	4.0	2.0	1.9	1.6	14.2	6.0	1.7	2.0	2.9
10	5.1	7.6	8.1	4.4	2.0	1.9	1.6	14.2	4.7	1.7	2.0	2.8
11	4.9	12.5	7.6	4.8	2.0	1.9	1.9	13.7	4.1	1.7	1.9	2.8
12	5.2	14.5	7.7	5.0	2.0	1.8	1.9	11.0	4.1	1.7	1.9	2.8
13	5.2	15.4	7.4	5.2	2.0	1.8	1.9	9.9	3.9	1.6	2.0	2.8
14	5.2	15.3	7.1	5.3	2.0	1.7	2.1	8.9	3.5	1.6	2.5	2.7
15	5.0	14.5	7.1	5.1	2.0	1.7	2.0	7.9	3.2	1.6	2.7	2.6
16	5.0	13.7	6.9	4.8	2.0	1.7	1.8	6.9	3.0	1.6	2.6	2.4
17	5.0	13.7	6.7	4.3	1.9	1.6	1.7	6.0	2.9	1.7	2.5	2.4
18	4.7	11.5	6.4	3.8	1.8	1.6	1.6	5.3	2.8	1.7	2.5	2.5
19	4.5	10.2	6.2	3.5	1.8	1.6	1.6	4.8	2.9	1.7	2.5	2.6
20	4.4	9.5	6.0	3.0	1.7	1.6	1.6	4.6	2.5	1.7	2.5	2.6
21	4.4	9.2	5.8	3.2	1.7	1.7	1.6	4.4	2.4	1.7	2.3	2.4
22	4.0	10.0	5.5	3.4	1.7	1.8	1.5	4.2	2.4	1.6	2.2	2.4
23	5.5	11.5	5.3	3.6	1.7	1.9	1.8	4.0	2.7	1.6	2.2	2.7
24	9.7	12.3	5.2	3.0	1.6	1.9	2.0	3.8	3.0	1.6	2.2	2.4
25	11.6	13.7	5.9	2.8	1.6	1.9	2.2	3.9	2.7	1.6	2.3	2.3
26	12.7	12.5	6.8	2.6	1.6	1.9	2.4	4.2	2.6	1.6	2.4	2.2
27	13.4	11.7	7.2	2.5	1.6	1.9	2.2	4.5	2.5	1.5	2.4	2.2
28	12.2	10.2	8.0	2.5	1.6	1.8	2.0	4.9	2.4	1.5	2.2	2.2
29	11.0	9.8	7.6	2.5	1.9	1.8	2.0	5.2	2.3	1.5	2.2	2.4
30	10.5	.....	6.9	2.3	1.8	1.8	1.9	5.6	2.2	1.5	2.2	2.5
31	9.8	.....	6.3	.....	1.9	.....	2.3	5.9	.....	1.5	.....	2.7
1905.												
1	2.6	3.3	9.8	6.2	4.9	2.5	2.0	3.0	3.2	1.5	1.4	1.3
2	2.6	3.3	8.7	6.2	4.9	2.6	2.2	3.9	3.0	1.5	1.3	1.3
3	2.6	3.3	7.7	5.5	4.9	2.4	2.5	3.6	2.8	1.5	1.3	1.8
4	2.6	3.3	7.5	5.3	4.7	2.3	2.4	3.5	2.4	1.4	1.3	2.2
5	2.6	3.2	7.0	5.1	4.5	2.1	2.3	3.5	2.0	1.4	1.3	2.5
6	2.6	3.4	6.3	5.4	4.5	1.9	3.7	3.4	2.4	1.4	1.3	2.4
7	2.7	3.6	6.4	5.7	4.5	1.8	4.5	3.0	2.6	1.4	1.3	2.2
8	2.9	4.0	6.2	5.7	4.5	1.8	7.4	2.8	2.4	1.5	1.3	2.3
9	2.9	4.7	6.2	5.6	4.4	1.7	7.5	2.6	2.2	1.6	1.3	2.5
10	2.8	5.3	6.2	5.6	4.3	1.7	7.7	2.5	2.2	1.5	1.3	2.8
11	2 8	5.6	6.7	6.0	4.0	1.6	7.7	2.2	2.0	1.4	1.5	2.8
12	2.8	6.6	8.0	6.0	3.4	1.6	7.9	2.0	2.0	1.4	1.5	2.7
13	3.0	8.1	10.4	6.4	3.0	1.6	8.0	2.3	1.9	1.4	1.5	2.5
14	3.5	10.1	13.4	7.2	3.0	1.6	7.2	2.6	1.8	1.4	1.5	2.8
15	4.0	11.2	14.2	7.4	3.0	1.6	6.5	3.1	1.8	1.4	1.4	3.0
16	4.5	11.9	14.1	9.2	2.9	1.8	6.5	3.1	1.9	1.4	1.3	3.4
17	4.4	13.1	13.9	6.8	2.5	2.0	6.5	3.1	1.8	1.4	1.3	3.3
18	4.3	14.8	13.8	6.5	2.4	2.6	6.0	3.2	1.7	1.4	1.3	3.2
19	4.2	14.5	13.7	6.5	2.4	2.8	6.2	3.3	1.9	1.3	1.3	3.0
20	4.1	13.1	13.0	6.4	2.4	3.1	6.3	4.0	1.9	1.3	1.3	3.1
21	4.1	11.0	12.1	6.2	2.4	3.3	5.3	5.0	2.0	1.3	1.3	3.6
22	4.0	10.5	11.2	6.0	2.6	3.0	3.8	5.6	2.0	1.3	1.3	4.3
23	3.9	11.6	10.2	5.9	2.7	2.5	3.2	6.0	1.8	1.3	1.3	4.2
24	3.6	11.7	9.2	5.8	2.8	2.6	3.1	4.2	1.7	1.3	1.4	4.8
25	3.6	11.5	8.0	5.9	2.9	2.6	2.6	3.3	1.7	1.3	1.4	5.1
26	3.5	13.0	8.9	6.1	2.8	2.5	2.1	3.0	1.6	1.4	1.4	5.0
27	3.5	12.0	7.6	6.1	2.8	2.3	2.0	3.2	1.6	1.4	1.4	4.8
28	3.4	10.7	6.9	5.8	2.8	2.0	2.2	3.5	1.6	1.4	1.3	4.7
29	3.2	.....	6.7	5.4	2.7	1.9	2.3	3.6	1.5	1.4	1.3	4.7
30	3.1	.....	6.5	5.0	2.6	1.8	2.3	3.7	1.5	1.4	1.3	4.8
31	3.3	.....	6.2	.....	2.5	.....	2.9	3.4	.....	1.4	.....	4.7

Rating tables for Cannoochee River near Groveland.

JUNE 23 TO DECEMBER 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	142	3.90	316	6.40	1,150	9.00	2,060
2.70	151	4.00	338	6.60	1,220	9.50	2,235
2.80	160	4.20	389	6.80	1,290	10.00	2,410
2.90	170	4.40	451	7.00	1,360	10.50	2,585
3.00	180	4.60	520	7.20	1,430	11.00	2,760
3.10	191	4.80	590	7.40	1,500	11.50	2,935
3.20	203	5.00	660	7.60	1,570	12.00	3,110
3.30	216	5.20	730	7.80	1,640	13.00	3,460
3.40	230	5.40	800	8.00	1,710	14.00	3,810
3.50	245	5.60	870	8.20	1,780	15.00	4,160
3.60	261	5.80	940	8.40	1,850	16.00	4,510
3.70	278	6.00	1,010	8.60	1,920	17.00	4,860
3.80	296	6.20	1,080	8.80	1,990	18.00	5,210

JANUARY 1 TO DECEMBER 31, 1904.[b]

1.50	30	2.70	149	4.60	554	8.50	1,740
1.60	36	2.80	165	4.80	606	9.00	1,915
1.70	42	2.90	182	5.00	660	9.50	2,095
1.80	49	3.00	200	5.20	714	10.00	2,275
1.90	57	3.10	218	5.40	769	11.00	2,650
2.00	65	3.20	237	5.60	825	12.00	3,025
2.10	74	3.40	276	5.80	882	13.00	3,400
2.20	84	3.60	317	6.00	940	14.00	3,775
2.30	95	3.80	360	6.50	1,090	15.00	4,150
2.40	107	4.00	405	7.00	1,245		
2.50	120	4.20	453	7.50	1,405		
2.60	134	4.40	503	8.00	1,570		

JANUARY 1 TO DECEMBER 31, 1905.[c]

1.30	27	1.90	66	2.50	131	3.10	220
1.40	32	2.00	75	2.60	144	3.20	238
1.50	38	2.10	85	2.70	158	3.30	257
1.60	44	2.20	96	2.80	172		
1.70	51	2.30	107	2.90	187		
1.80	58	2.40	119	3.00	203		

[a] Above gage height 4.50 feet the rating curve is a tangent, the difference being 35 per tenth.
[b] Above 10 feet the rating curve is a tangent, the difference being 75 per 0.2 foot rise in gage.
[c] Above 3.3 feet this table is the same as the one for 1904.

Estimated monthly discharge of Cannoochee River near Groveland.

[Drainage area, 960 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec. ft. per sq. mile.	Depth in inches.
1903.					
-30	2,060	730	1,141	1.19	0.354
	2,620	151	1,242	1.29	1.49
	4,930	142	2,100	2.19	2.52
ber	5,210	261	1,855	1.93	2.15
r	2,200	278	774	.806	.929
ber	1,325	296	646	.673	.751
ber	1,605	296	499	.520	.600
1904.					
y	3,550	405	1,317	1.37	1.58
ry	4,300	1,000	2,508	2.61	2.82
	2,131	714	1,301	1.36	1.57
	911	95	428	.446	.498
	107	36	60.8	.063	.073
	65	36	52.2	.054	.060
	107	30	52.6	.055	.063
	3,850	360	1,324	1.38	1.59
ber	1,183	84	390	.406	.453
r	74	30	42.0	.044	.051
ber	149	30	84.1	.088	.098
ber	182	74	122	.127	.146
he year	4,300	30	640	.667	9.00
1905.					
y	528	144	279	.291	.336
ry	4,075	238	1,885	1.96	2.04
	3,850	1,000	2,050	2.14	2.47
	1,987	660	976	1.02	1.14
	633	119	299	.311	.358
	257	44	102	.106	.118
	1,570	75	649	.676	.779
	940	75	297	.309	.356
ber	238	38	84.6	.088	.098
r	44	27	32.2	.034	.039
ber	38	27	29.5	.031	.035
ber	687	27	295	.307	.354
he year	4,075	27	582	.606	8.12

MISCELLANEOUS MEASUREMENTS IN OGEECHEE RIVER DRAINAGE BASIN.

Buckhead Creek.—This stream was measured at Daniels Bridge, 1 mile northwest of Millen. The bench mark is the top of first bent from a large cypress stump near the right bank, downstream side of bridge.

Discharge measurements of Buckhead Creek at Daniels Bridge, 1 mile northwest of Millen.

Date.	Height of bench mark above water.	Discharge.
1903.	*Feet.*	*Sec.-ft.*
June 10	4.68	67
June 11	3.33	1.16
June 20	6.71	52
July 18	5.02	30
October 10	9.34	16

Bull Creek.—At the new bridge 2 miles southeast of Claxton this stream was discharging 18 second-feet on June 22, 1903, when the water surface was 5.40 feet below the top of the upstream end of the cap of the first bent from right bank.

Cannoochee River.—At Moores Bridge, 2½ miles northwest of Groveland, this stream was discharging 1,958 second-feet on June 9, 1903, when the water surface was 6.87 feet below the top of the first bent from the right bank, upstream side of bridge.

At Hendrix Bridge, 1½ miles from Claxton, this stream was discharging 469 second-feet on June 22, 1903, when the water surface was 13.40 feet below the bridge floor at 50 feet from the outer edge of the post at the end of the hand rail, right bank, upstream side.

Cedar Creek.—At 1¾ miles northwest of Claxton this stream was discharging 11 second-feet on June 22, 1903, when the water surface was 10.13 feet below the bridge floor at midstream.

Little Ogeechee River.—Near Agricola this stream was discharging 4.2 second-feet on October 14, 1903, when the water surface was 13.83 feet below the top of the floor at the hand-rail brace.

Lotts Creek.—This stream was measured at a foot log 100 yards above its mouth, about 2 miles northwest of Groveland. The bench mark is a large spike in a 9 by 9 post near right bank.

Discharge measurements of Lotts Creek about 2 miles northwest of Groveland.

Date.	Height of bench mark above water.	Discharge.
1903.	*Feet.*	*Sec.-ft.*
June 23	8.00	253
October 9	9.47	119
October 9	9.47	112

A measurement made June 12, 1905, gave the following results:

Width, 16 feet; area, 11.4 square feet; mean velocity, 1.18 feet per second; discharge, 13 second-feet.

Ogeechee River.—At Harrisons Bridge, 2 miles west of Agricola, this stream was discharging 24 second-feet on October 14, 1903, when the water surface was 19.56 feet below the top of the bent at the right end of the bridge, downstream side.

At the wagon bridge 5 miles northeast of Davisboro this stream was discharging 197 second-feet on November 20, 1903, when the water surface was 12.20 feet below the top of the second bent from the left bank.

Williamsons Swamp Creek (west prong).—At Buffalo Ford, near Sandersville, this stream was discharging 16 second-feet on July 2, 1903, when the water was at ordinary stage.

Williamsons Swamp Creek (north prong).—At Jones Bridge, near Sandersville, this stream was discharging 19 second-feet on July 2, 1903, when the water was at ordinary stage.

Williamsons Swamp Creek.—At Jordans Mill Bridge, near Sandersville, this stream was discharging 95 second-feet on July 2, 1903, when the water was at ordinary stage.

ALTAMAHA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Altamaha River is formed by the junction of Oconee and Ocmulgee rivers, which unite at the southern boundary of Montgomery County, Ga. Ohoopee River is also a tributary, entering from the north side about 50 miles below the junction of the Oconee and Ocmulgee. The Altamaha River drainage is entirely within the State of Georgia. The river rises in the north-central part and flows in a southeasterly direction, emptying into the Atlantic Ocean near Darien. Below the junction of the Oconee and Ocmulgee and for a long distance above, on both rivers, there is no great amount of fall. Steamboat navigation is carried on from Darien to Macon on the Ocmulgee, and to Dublin, and at times to Milledgeville, on the Oconee.

Ohoopee River rises in Washington County and flows in a southeasterly direction to the Altamaha. It flows from the low hills of southeastern Georgia into the flat pine lands. Though it has not so much fall as the more northern streams, it has considerable fall that can be developed into power.

Oconee River rises on the southern slope of the Chattahoochee Ridge, in Hill County, and joins the middle Oconee on the southwest boundary of Clarke County. From there it flows in a southeasterly direction to the Altamaha. Apalachee River is a large tributary which rises in Gwinnett and Walton counties and enters the Oconee near the southeastern corner of Morgan County. Little River enters the main stream at the corner of Putnam, Hancock, and Baldwin counties, about 15 miles above Milledgeville, Ga. These tributaries

have much fall, and a small part of it is developed. The Oconee has a fall of 250 feet in 45 miles. It has some very large water powers available from its source down to Milledgeville, where it crosses the fall line.

Ocmulgee River, the most westerly of the main tributaries, rises in the north-central part of Georgia on the southern slope of the Chattahoochee Ridge in Fulton, Dekalb, and Gwinnett counties. It is formed by the junction of Yellow and South rivers just south of the southern corner of Newton County. Yellow River rises in Gwinnett County and flows in a southerly direction into the Ocmulgee. South River rises in Fulton and Dekalb counties and flows in a southeasterly direction. Alcovy River joins the Ocmulgee about 5 miles below the junction of the South and Yellow rivers. Towaliga River enters the Ocmulgee at about the southwest corner of Jasper County.

All these tributaries rise in and flow through a very hilly country and have a great deal of fall. Ocmulgee River has a fall of over 210 feet in 35 miles. The last fall of much size is only a few miles above Macon, Ga.

STREAM FLOW.

SOUTH RIVER NEAR LITHONIA.

This station was established by F. A. Murray on August 17, 1903, a short distance above Albert Shoals, 6 miles south of Lithonia, and was discontinued on December 31, 1904.

The channel above the station is nearly straight for about 300 feet, and the current is sluggish, being held back by rock ledges below the station. Below the station the channel curves slightly and the current is sluggish for about 400 feet, at which point the shoals begin. The right bank is low and overflows at a gage height of 9 or 10 feet into a second channel, which has a width at high water of about 200 feet. The left bank is high and rocky, and does not overflow. The bottom is solid rock.

Discharge measurements were made from the 3-span wooden highway bridge. The initial point for soundings is the end of the bridge on the right bank, upstream side.

The gage is a vertical 10-foot rod fastened to a tree on the right bank just below the bridge. It was read once each day by W. N. New, who was paid by the Georgia Geological Survey.

Bench mark No. 1 is the top of the upstream end of the first wooden floor beam from the right bank; elevation, 15.00 feet above the zero of the gage. Bench mark No. 2 is the center of a wire nail driven horizontally in the upstream side of the base of a willow tree on the left bank about 40 feet upstream from the bridge; elevation, 4.00 feet above the zero of the gage.

Discharge measurements of South River near Lithonia.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
August 17	3.55	179	March 11	3.67	185
September 10	3.43	104	July 16	3.22	58
September 10[a]	3.46	120	August 9	4.90	1,172
October 5	3.40	104	August 9	4.60	934
1904.			August 10	4.53	812
January 13	3.58	138	September 23	3.16	55
March 7	4.20	549	December 5	4.28	588

[a] Parkers Bridge, 1 mile above station.

Daily gage height, in feet, of South River near Lithonia.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.						1903.					
1		3.5	3.5	3.5	3.5	17	3.5	3.9	3.5	3.5	3.5
2		3.4	3.5	3.5	3.5	18	4.1	3.6	3.6	3.6	3.5
3		3.5	3.5	3.5	3.5	19	3.8	3.5	3.5	3.6	3.5
4		3.4	3.5	4.6	3.5	20	3.6	3.4	3.5	3.5	3.6
5		3.4	3.5	4.0	3.5	21	3.5	3.5	3.5	3.5	3.5
6		3.4	3.5	3.6	3.5	22	3.6	3.5	3.5	3.5	3.5
7		3.5	3.5	3.6	3.5	23	3.4	3.5	3.5	3.5	3.5
8		3.4	3.5	3.6	3.5	24	3.5	3.5	3.5	3.5	3.5
9		3.4	3.5	3.6	3.5	25	3.5	3.5	3.5	3.5	3.5
10		3.4	3.5	3.6	3.5	26	3.5	3.5	3.5	3.5	3.6
11		3.5	3.5	3.6	3.5	27	3.6	3.5	3.5	3.6	3.5
12		3.4	3.5	3.5	3.5	28	3.5	3.5	3.5	3.6	3.5
13		3.5	3.5	3.5	3.6	29	3.6	3.5	3.5	3.5	3.5
14		3.4	3.5	3.6	3.5	30	3.6	3.5	3.5	3.5	3.5
15		4.5	3.5	3.5	3.5	31	3.4		3.5		3.5
16		4.4	3.5	3.5	3.5						

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
1	3.5	3.6	3.6	3.6	3.6	4.1	3.7	3.6	3.5	3.4	3.3	3.5
2	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.5	3.4	3.3	3.5
3	3.5	3.6	3.6	3.6	3.6	3.6	3.6	4.3	3.5	3.4	3.3	3.5
4	3.5	3.5	3.7	3.6	3.6	3.5	3.5	3.6	4.2	3.4	3.3	3.5
5	3.5	3.5	3.6	3.6	3.6	3.6	3.5	3.5	3.8	3.4	3.3	4.3
6	3.5	3.6	3.5	3.6	3.5	3.8	3.5	3.7	3.6	3.4	3.3	3.7
7	3.5	3.6	4.2	3.7	3.5	4.4	3.5	5.7	3.6	3.4	3.3	3.6
8	3.5	4.1	4.1	3.7	4.1	3.8	3.5	6.8	3.6	3.4	3.3	3.6
9	3.5	3.7	3.65	3.6	3.7	3.7	3.5	6.5	3.6	3.3	3.3	3.5
10	3.5	4.5	3.6	3.7	3.6	3.6	3.6	4.6	3.6	3.2	3.3	3.6
11	3.5	4.3	3.7	3.6	3.6	3.6	3.5	3.8	3.6	3.3	3.3	3.6
12	3.5	3.7	3.7	3.7	3.6	3.6	3.6	3.7	3.6	3.3	3.3	3.6
13	3.5	3.6	3.6	3.7	3.6	3.6	3.6	3.6	3.5	3.3	3.4	3.6
14	3.5	3.7	4.1	3.6	3.6	3.5	3.6	3.6	3.5	3.3	3.3	3.6
15	3.6	3.7	3.7	3.6	3.6	3.5	3.5	3.7	3.5	3.3	3.3	3.6
16	3.5	3.6	3.7	3.6	3.6	3.5	3.5	4.2	3.5	3.2	3.3	3.6
17	3.7	3.6	3.65	3.6	3.6	3.5	3.5	3.8	3.6	3.2	3.3	3.6
18	3.6	3.7	3.6	3.6	3.6	3.5	3.6	3.6	3.5	3.2	3.3	3.6
19	3.6	3.7	3.6	3.6	3.5	3.5	3.5	4.1	3.5	3.3	3.3	3.6
20	3.6	4.5	3.6	3.6	3.5	3.6	3.5	3.6	3.5	3.3	3.3	3.6
21	3.6	4.1	3.6	3.6	3.5	3.6	3.5	3.6	3.5	3.3	3.3	3.6
22	4.6	4.6	3.7	3.6	3.6	3.8	3.5	3.6	3.5	3.3	3.4	3.6
23	4.2	4.5	3.7	3.6	3.5	3.7	3.7	3.5	3.5	3.3	3.4	3.6
24	4.1	4.3	3.7	3.6	3.5	3.6	3.6	3.5	3.5	3.2	3.4	3.6
25	4.1	3.8	3.7	3.6	3.5	3.6	3.5	3.6	3.5	3.2	3.4	3.6
26	3.6	3.7	3.7	3.7	3.5	3.5	3.5	3.5	3.5	3.2	3.4	3.6
27	3.6	3.7	3.6	3.7	3.5	3.5	3.5	3.6	3.5	3.2	3.4	3.8
28	3.5	3.7	3.6	3.6	3.5	3.8	3.5	3.7	3.4	3.2	3.4	3.9
29	3.5	3.6	3.6	3.6	3.5	3.8	4.5	3.6	3.4	3.2	3.4	3.6
30	3.5		3.6	3.6	3.8	3.8	3.7	3.6	3.4	3.2	3.4	3.6
31	3.5		3.6		4.6		3.5	3.5		3.2		3.6

[illegible] South River near Lithonia, from August 17, 1903, to December 31, 1

[illegible]	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
[illegible]	[illegible]	[illegible]	5.00	1,220	5.80	2,050
			5.10	1,320	5.90	2,190
			5.20	1,420	6.00	2,340
			5.30	1,520	6.20	2,660
			5.40	1,630	6.40	3,020
			5.50	1,720	6.60	3,400
			5.60	1,820	6.80	3,800
			5.70	1,930		

[illegible] monthly discharge of South River near Lithonia.

[illegible]	Discharge in second-feet.		
	Maximum.	Minimum.	Me
[illegible]			
[illegible]	454	100	
[illegible]	764	100	
[illegible]	168	130	
[illegible]	848	130	
[illegible]	168	130	
[illegible]			
[illegible]	848	130	
[illegible]	848	130	
[illegible]	530	130	
[illegible]	214	168	
[illegible]	848	130	
[illegible]	764	130	
[illegible]	764	130	
[illegible]	3,800	130	
[illegible]	530	100	
[illegible]	100	55	
[illegible]	100	77	
[illegible]	606	130	
[illegible]	3,800	55	

[illegible] GAGE NEAR SNAPPING SHOALS.

This [illegible] was [illegible] in 1903 for the purpose of maki[illegible] measurements. It is located [illegible] known as Butlers Bridge, about 15 [illegible] from [illegible] miles above Snapping Shoals, where t[illegible]

The [illegible] and is fairly swift at lowest water. [illegible] at low water. The right bank may ove[illegible] the bridge approach at high floods. The left bank wil[illegible] The bed is sandy and will probably change.

[illegible] are determined directly from the bench mark, w[illegible] the downstream end, at the edge of the floor, of the [illegible] from the left end of the third span from th[illegible] feet above the datum of the assumed gag[illegible]

Discharge measurements of South River near Snapping Shoals.

Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*
October 23	3.46	120
October 24	3.56	135

OCMULGEE RIVER NEAR FLOVILLA.

A station was established July 26, 1901, on Ocmulgee River at Lamars Ferry, one-half mile below Lamar's mill and 5 miles east of Flovilla. The object of this station was to compare the discharge of the river at this point with its discharge below, at Macon, through the low-water season. The gage and bench marks were washed away by a flood February 27, 1902. The station was reestablished June 18, 1903, at Lamars Ferry, by M. R. Hall.

The channel is straight for 1,000 feet above and 5,000 feet below the station. The current is swift and regular. The right bank is high, but overflows at extreme high water. The left bank is somewhat lower. The bed of the stream is sandy and shifting, and there is but one channel.

Discharge measurements are made from the ferryboat. The initial point for soundings is the windlass on the right bank.

The vertical gage is in three sections: The first section, reading from 0 to 5 feet, is fastened to a willow tree at the mouth of a small branch about 20 feet above the ferry landing on the right bank; the second section, reading from 5 to 15 feet, is nailed to an ash tree about 60 feet from the river up the same branch; the third section, reading from 15 to 25 feet, is attached to a cottonwood tree on the bank of the same branch, about 200 feet from the river. No attempt was made to place this gage on the same datum as the old one. The gage is read once each day by B. S. White, who is paid by the Georgia Geological Survey. During the low-water period from October 1 to December 31, 1905, the gage was read twice each day. Bench marks were established as follows: (1) A nail driven into a large cottonwood tree about 200 feet from the river, on the branch on which the gage is located; elevation, 14.00 feet. (2) A cross in the solid rock, 100 feet uphill from the first bench mark and 140 feet north from the wagon road, at a point 250 feet west of the ferry; elevation, 34.24 feet. Elevations refer to the datum of the gage.

Discharge measurements of Ocmulgee River near Flovilla.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
July 26	a 2.93	1,695	January 22	5.50	
September 12	a 2.10	1,087	February 16	2.93	
November 5	a 2.20	948	April 15	1.67	
1902.			May 28	.50	
February 10	a 5.60	2,376	June 17	.47	
1903.			July 12	1.39	
June 18	2.00	1,383	August 26	2.36	
August 25	1.61	993	September 20	−.03	
September 29	1.35	771	October 6	−.21	
October 13	1.10	708	November 2	.03	
November 12	1.78	1,070	December 21	.93	
December 19	1.61	879	1905.		
1904.			March 25	1.88	
January 13	1.97	1,130	June 15	1.16	
January 21	1.85	1,003	July 24	.34	
			September 29	−.32	
			November 3	.27	

a Old gage for 1901 and 1902 measurements.

Daily gage height, in feet, of Ocmulgee River near Flovilla.

Date.	July	Aug.	Sept.	Oct.	Nov.	Dec.	Date.	July.	Aug.	Sept.	Oct.	Nov.
1901							1901.					
1		3.0	7.9	3.5	2.7	2.8	17		10.0	7.5	3.0	2.7
2		2.7	6.7	5.9	2.8	2.7	18		2.7	17.4	3.0	2.7
3		2.6	4.5	6.5	2.8	3.8	19		6.9	13.8	2.9	2.7
4		2.5	4.1	5.1	2.8	4.2	20		5.0	9.0	2.9	3.2
5		2.7	3.7	4.0	2.8	3.7	21		5.4	6.8	2.9	3.2
6		6.0	3.6	3.6	2.8	3.4	22		9.0	6.0	2.9	3.1
7		6.5	3.4	3.4	2.8	3.6	23		16.0	5.7	2.9	3.0
8		5.0	3.3	3.3	2.8	3.2	24		16.5	5.3	2.9	3.0
9		3.9	3.2	3.2	2.8	3.1	25		7.0	4.9	2.8	3.0
10		2.2	3.1	3.2	2.8	3.4	26	2.9	6.1	4.2	2.7	2.9
11		10.5	3.1	3.2	2.8	3.8	27	2.8	8.7	3.5	2.8	2.9
12		5.2	3.1	3.1	2.8	3.6	28	3.5	9.7	3.5	2.8	2.8
13		5.3	3.0	3.5	2.8	3.4	29	3.1	8.9	4.0	2.8	2.8
14		4.0	4.0	3.4	2.8	3.3	30	3.6	7.1	4.0	2.8	2.8
15		4.5	3.5	3.2	2.8	10.2	31	3.4	5.8	.....	2.8	.....
16		12.4	3.2	3.0	2.7	6.8						

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.
1902.			1902.			1902.			1902.	
1	14.0	14.6	9	4.4	5.7	17	3.8	5.5	25	4.0
2	9.0	19.0	10	4.3	5.6	18	3.7	5.3	26	4.3
3	6.5	20.2	11	4.1	5.3	19	3.9	5.0	27	4.4
4	5.7	19.5	12	4.1	5.7	20	4.1	5.5	28	4.1
5	5.2	10.0	13	4.0	5.0	21	4.2	5.8	29	4.7
6	5.0	8.1	14	3.7	4.8	22	4.7	5.6	30	5.4
7	4.8	7.2	15	3.7	5.2	23	4.5	5.4	31	5.3
8	4.5	6.5	16	4.0	5.7	24	4.2	5.1		

a Gage washed out February 28, 1902.

Daily gage height, in feet, of Ocmulgee River near Flovilla—Continued.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.							1903.						
	2.2	1.6	1.2	1.3	1.2	1.5	17	2.9	3.3	6.5	1.8	1.5	1.7
	1.9	1.4	1.1	1.3	1.2	1.5	18	2.4	7.5	3.9	1.8	1.7	1.7
	2.3	2.1	1.1	1.3	1.3	1.4	19	2.3	6.1	2.8	1.7	1.7	1.6
	2.9	4.0	1.3	1.2	1.4	1.7	20	2.1	3.4	2.4	1.5	1.8	1.7
	2.7	3.4	1.1	1.2	3.2	1.6	21	1.9	2.7	1.9	1.4	1.5	2.0
	2.1	2.7	0.9	1.2	2.2	1.6	22	1.7	2.4	1.8	1.3	1.5	2.0
	2.6	2.1	0.9	1.2	2.1	1.6	23	1.6	2.1	1.7	1.2	1.6	1.9
	3.2	1.7	0.9	1.3	2.3	1.7	24	1.5	1.9	1.6	1.2	1.6	1.7
	3.8	1.5	0.8	1.3	1.5	1.6	25	1.5	1.6	1.5	1.1	1.7	1.7
	2.8	1.4	0.7	1.3	1.6	2.1	26	1.4	1.5	1.5	1.1	1.6	2.0
	3.2	1.3	0.9	1.2	1.4	2.0	27	1.3	1.4	1.4	1.1	1.6	2.5
	5.3	1.7	0.8	1.1	1.8	1.8	28	1.2	1.3	1.4	1.2	1.5	1.9
	4.5	1.3	0.8	1.1	1.7	1.7	29	1.3	1.2	1.4	1.2	1.5	1.8
	9.5	3.8	1.1	1.0	1.6	1.9	30	1.5	1.1	1.3	1.2	1.5	1.7
	6.6	5.2	6.2	0.9	1.5	1.8	31	2.0	1.2	.....	1.2	.....	1.7
	4.0	9.2	9.9	1.2	1.5	1.7							

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.						1904.					
	2.7	0.7	−0.3	−0.3	0.6	17	4.0	0.0	−0.6	0.6	1.0
	2.7	.7	− .3	− .2	.6	18	2.7	.0	− .6	.5	1.0
	2.2	.3	− .3	.2	.8	19	1.7	.0	− .4	.4	1.0
	3.2	.4	− .5	.7	1.2	20	1.5	− .1	− .4	.4	.9
	1.5	3.7	− .3	.9	1.8	21	1.1	− .1	− .3	.2	1.0
	1.0	2.3	− .3	.7	4.0	22	1.2	− .1	− .3	.5	.9
	4.25	1.4	− .3	.6	3.8	23	.9	.4	− .3	.9	.9
	7.4	1.0	− .3	.4	3.0	24	1.3	.0	− .4	.5	.8
	10.5	.8	− .3	.3	2.0	25	.9	− .2	− .6	.4	.8
	11.0	.5	− .4	.1	2.8	26	2.4	− .3	− .6	.8	.7
	7.6	.4	− .5	.1	1.4	27	1.5	− .3	− .2	.7	1.0
	5.0	.3	− .3	.1	1.5	28	1.4	− .2	− .2	.4	3.5
	4.0	.4	− .3	.6	1.3	29	2.2	− .1	− .2	.6	3.5
	3.9	.3	− .3	1.1	1.0	30	1.1	− .2	− .1	.5	3.0
	2.0	.2	− .4	1.0	1.0	31	.9	.....	− .3	.....	1.9
	4.1	.2	− .4	.8	.9						

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
	1.6	1.4	2.6	1.5	1.4	1.0	6.0	0.5	0.3	−0.2	0.35	0.65
	1.5	1.5	2.5	1.5	1.3	.8	6.0	.4	.7	.4	.25	.65
	1.4	1.4	2.4	1.4	2.1	.7	4.2	.3	1.6	1.15	.20	11.2
	1.2	1.5	2.3	1.6	3.0	.8	2.4	.0	.5	.65	.15	14.4
	1.1	1.4	2.1	1.7	3.2	.7	2.5	.1	.6	.6	.1	10.4
	1.3	1.5	2.0	2.2	2.5	.7	2.1	.2	.5	.45	.1	4.8
	1.7	1.4	2.0	2.0	2.0	.6	3.7	.3	.3	.25	.5	4.0
	1.8	5.0	2.0	1.8	1.8	.5	2.6	.5	.1	− .1	.4	3.4
	1.8	6.9	2.0	2.2	1.9	.4	2.4	2.1	.2	− .15	.3	6.6
	1.4	7.1	2.4	4.3	1.5	.2	1.7	2.5	.0	.05	.9	8.6
	1.5	6.2	2.1	3.0	1.3	.0	4.3	2.9	− .1	.8	3.5	6.1
	2.0	5.5	2.4	2.4	1.2	.0	3.4	9.2	− .1	1.05	2.55	4.2
	6.2	12.6	3.0	2.1	1.0	1.7	7.0	6.3	.1	.75	1.75	4.0
	6.9	10.5	2.7	1.9	.9	1.0	4.0	4.3	.1	.5	1.25	3.6
	6.0	7.2	2.5	1.5	.8	.7	2.9	5.8	.2	.35	1.0	4.0
	2.1	5.0	2.2	2.0	1.5	1.2	2.1	3.7	.0	.3	.65	3.8
	2.8	4.2	1.9	1.8	1.4	1.1	1.7	2.2	.1	.4	.25	3.4
	2.6	4.0	1.9	1.6	1.3	.9	1.5	2.0	.0	.3	.4	3.0
	2.1	3.5	1.8	1.4	1.0	.7	1.2	1.4	− .2	.42	.5	1.9
	2.1	3.3	1.7	1.5	.8	.4	1.0	1.1	− .2	.72	.45	7.2
	2.0	5.5	2.1	1.4	.6	.3	.9	.9	− .2	.0	.55	14.6
	1.8	6.6	2.5	1.3	.8	.2	.6	.8	− .3	.0	.6	9.3
	1.7	5.3	2.2	1.3	1.3	1.8	.4	.7	− .3	.0	.58	5.0
	1.6	4.3	2.0	1.3	3.9	2.3	.3	2.5	− .4	.2	.5	6.0
	1.4	3.9	1.9	1.3	4.0	1.3	.6	2.4	− .5	.2	.5	5.2
	1.3	3.6	1.7	1.2	3.6	1.1	1.9	1.2	− .6	.7	.5	3.6
	1.4	3.2	1.6	1.2	2.2	1.5	1.5	.7	− .4	.7	.75	3.5
	1.3	2.8	1.5	1.1	2.0	1.9	.8	.5	− .5	.6	.85	3.4
	1.5	.....	1.4	1.0	1.9	2.2	.5	.4	− .4	.4	.80	3.8
	1.4	.....	1.5	2.0	1.7	1.4	.3	.4	− .2	.35	.75	3.6
	1.5	.....	1.4	.....	1.5	.....	.2	.3	.....	.3	.....	3.5

Rating tables for Ocmulgee River near Flovilla.

JULY 26, 1901, TO FEBRUARY 27, 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	835	3.60	1,344	5.40	2,271	13.00	6,185
2.60	870	3.70	1,395	5.60	2,374	14.00	6,700
2.70	907	3.80	1,447	5.80	2,477	15.00	7,215
2.80	947	3.90	1,498	6.00	2,580	16.00	7,730
2.90	990	4.00	1,550	6.50	2,837	17.00	8,245
3.00	1,037	4.20	1,653	7.00	3,095	18.00	8,760
3.10	1,087	4.40	1,756	8.00	3,610	19.00	9,275
3.20	1,138	4.60	1,859	9.00	4,125	20.00	9,790
3.30	1,189	4.80	1,962	10.00	4,640	21.00	10,305
3.40	1,241	5.00	2,065	11.00	5,155	22.00	10,820
3.50	1,292	5.20	2,168	12.00	5,670	23.00	11,335

JULY 1 TO DECEMBER 31, 1903.[b]

0.70	635	2.00	1,120	3.30	2,010	5.00	3,200
.80	648	2.10	1,185	3.40	2 080	5.50	3,550
.90	663	2.20	1,250	3.50	2,150	6.00	3,900
1.00	680	2.30	1,315	3.60	2,220	6.50	4,250
1.10	700	2.40	1,380	3.70	2,290	7.00	4,600
1.20	725	2.50	1,450	3.80	2,360	7.50	4,950
1.30	755	2.60	1,520	3.90	2,430	8.00	5,300
1.40	790	2.70	1,590	4.00	2,500	8.50	5,650
1.50	832	2.80	1,660	4.10	2,570	9.00	6,000
1.60	880	2.90	1,730	4.20	2,640	9.50	6,350
1.70	935	3.00	1,080	4.30	2,710	10.00	6,700
1.80	995	3.10	1,870	4.40	2,780		
1.90	1,055	3.20	1,940	4.50	2,850		

AUGUST 1 TO DECEMBER 31, 1904.

−0.60	200	0.60	525	1.80	1,020	4.00	2,350
− .50	225	.70	560	1.90	1,070	4.20	2,490
− .40	250	.80	595	2.00	1,120	4.40	2,640
− .30	275	.90	630	2.20	1,225	4.60	2,790
− .20	300	1.00	670	2.40	1,335	4.80	2,940
− .10	325	1.10	710	2.60	1,450	5.00	3,090
.00	350	1.20	750	2.80	1,570	5.50	3,475
.10	375	1.30	790	3.00	1,690	6.00	3,875
.20	400	1.40	835	3.20	1,820	6.50	4,275
.30	430	1.50	880	3.40	1,950	7.00	4,675
.40	460	1.60	925	3.60	2,080	7.50	5,085
.50	490	1.70	970	3.80	2,210		

JANUARY 1 TO DECEMBER 31, 1905.[c]

−0.60	220	0.40	510	1.40	895	2.40	1,370
− .50	245	.50	545	1.50	940	2.50	1,420
− .40	270	.60	580	1.60	985	2.60	1,470
− .30	295	.70	615	1.70	1,030	2.70	1,525
− .20	325	.80	650	1.80	1,075	2.80	1,580
− .10	355	.90	690	1.90	1,120	2.90	1,635
.00	385	1.00	730	2.00	1,170	3.00	1,690
.10	415	1.10	770	2.10	1,220		
.20	445	1.20	810	2.20	1,270		
.30	475	1.30	850	2.30	1,320		

[a] Above gage height 4.00 feet the rating curve is a tangent, the difference being 51.5 per tenth.
[b] Above gage height 2.40 feet the curve is a tangent, the difference being 70 per tenth.
[c] Above gage height 3.0 feet the table is the same as that for 1904.

Estimated monthly discharge of Ocmulgee River near Flovilla.

[Drainage area, 1,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.					
	7,987	835	2,916	1.94	2.24
r	8,451	1,037	2,219	1.48	1.65
	2,837	907	1,223	.82	.94
r	1,138	907	1,593	1.06	1.18
	11,850	907	2,531	1.69	1.95
1902.					
	6,700	1,395	2,020	1.35	1.56
1-27	9,803	1,962	3,538	2.36	2.37
1903.					
	6,350	725	1,681	1.12	1.29
	6,140	700	1,635	1.09	1.26
r	6,630	635	1,285	.86	.96
	995	663	754	.50	.58
r	1,940	725	932	.62	.69
	1,450	790	981	.65	.75
1904.					
	8,100	630	2,005	1.34	1.54
r	2,145	275	507	.338	.377
	325	200	261	.174	.201
r	710	275	493	.329	.367
	2,350	525	987	.658	.759
1905.					
	4,595	770	1,328	.885	1.02
	9,540	895	2,917	1.94	2.02
	1,690	895	1,212	.808	.932
	2,565	730	1,071	.714	.797
	2,350	590	1,107	.738	.851
	1,320	385	722	.481	.537
	4,675	445	1,457	.971	1.12
	6,530	385	1,273	.849	.979
r	985	220	402	.268	.299
	790	325	512	.341	.393
r	2,015	415	651	.434	.484
	11,340	598	3,592	2.39	2.76
year	11,340	220	1,354	.902	12.19

OCMULGEE RIVER AT MACON.

A station was established at Macon January 21, 1893, by United States Weather Bureau. Discharge measurements were be by the United States Geological Survey in 1895, and a wire gage established on the bridge of the Macon, Dublin and Savannah R road and was set on the same datum as the Weather Bureau g For a time gage-height records were maintained by the Geolog Survey, as the Weather Bureau records were for a part of the y only and were discontinued altogether from June 30, 1897, to Jun 1899. Since June 1, 1899, the Weather Bureau gage-height rec have been taken continuously and have been furnished to the G logical Survey.

The channel is straight and without obstructions, except for bridge pier. The banks are high and not subject to overflow. bed of the river is soft and changeable. The station was a fairly g one until the spring of 1902, when the bed of the stream below station, which is of shifting sand, changed to such an extent a make the current very sluggish at low stages.

Discharge measurements are made from the downstream side the Fifth Street Bridge, an iron bridge of two 190-foot spans, loca about 500 feet above the railroad bridge. The initial point soundings is the end of the iron hand rail of the footway at the ri bank on the downstream side.

The Weather Bureau gage is a heavy timber bolted to the do stream portion of the right-bank stone pier of the Central of Geo Railway bridge. October 9, 1905, a standard chain gage was instal on the Fifth Street Bridge, on the outside of the latticed railing of t downstream footway at a point 85 feet from the right-bank e length of chain, 40.83 feet. Bench marks were established as follo (1) The top of the iron rim of the sidewalk 80 feet from the init point for soundings; elevation, 34.42 feet. (2) An aluminum tab on the wall at the west side of the door of the United States Gove ment building at the Mulberry street front. This bench mark marked 334 feet and has an elevation of 64.37 feet above the zero the gage.

Discharge measurements of Ocmulgee River at Macon.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
1895.		
ar 18	0.39	813
ar 23	.20	767
ber 13	1.59	1,530
1896.		
ry 28	5.52	3,436
2	— .10	791
0	— .82	[a] 442
t 6	2.97	2,045
t 31	— .13	651
ar 16	— .61	459
1897.		
15	16.75	25,530
	4.30	2,750
	3.50	2,275
8	2.10	1,592
1	2.85	2,111
2	1.85	1,479
9	.90	1,005
nber 23	— .35	504
nber 23	— .35	497
nber 7	.06	735
ber 6	1.20	1,356
1898.		
ry 7	.42	899
ary 10	.60	1,010
28	.36	976
30	.50	1,028
9	— .20	687
23	— .34	620
6	4.92	3,218
7	5.65	3,799
t 29	9.25	6,125
t 30	7.20	4,477
er 19	4.50	3,111
nber 5	1.90	1,474
1899.		
ary 1	9.72	6,302
ary 3	13.75	14,950
ary 3	13.75	14,780
ary 3	12.81	12,690
14	4.50	2,587
29	5.00	3,094
	1.60	1,015
	1.48	983
1	1.22	1,009
t 2	1.98	1,345
nber 14	1.70	1,314
nber 16	.80	793
er 21	2.30	1,814
ber 13	4.50	3,009
ber 15	2.50	1,540
1900.		
13	7.38	4,855
nber 20	2.40	1,369
ber 6	8.70	5,098
ber 21	12.82	9,621

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
1901.		
January 2	12.32	8,692
February 21	4.35	2,495
April 19	6.60	3,724
May 8	3.75	1,958
November 6	2.15	1,107
November 8	2.15	1,141
1902.		
June 26	3.53	1,074
July 25	3.50	689
July 31	4.20	1,126
September 15	3.61	885
September 18	3.30	705
October 23	3.10	829
November 13	3.10	779
November 26	9.29	6,483
November 26	9.59	5,900
December 5	9.00	4,612
1903.		
January 26	4.00	1,794
April 2	11.30	7,244
April 4	9.00	5,118
April 21	7.88	4,385
July 14	11.00	7,676
July 14	11.00	7,314
August 24	3.61	1,382
September 30	2.55	1,022
September 30	2.56	1,057
October 15	2.22	926
October 15	2.28	915
November 13	2.84	1,236
December 21	2.88	1,264
December 21	2.95	1,329
1904.		
February 17	4.35	2,232
April 11	3.52	1,759
May 24	1.38	703
May 27	1.29	625
July 20	1.87	1,011
August 19	3.31	1,584
September 20 [b]	.30	431
October 6 [c]	— .20	232
November 1 [c]	— .14	302
1905.		
March 14	4.88	2,554
June 14	1.22	789
September 13	.71	772
September 28	— .39	321
November 4 [d]	.46	565

[a] Lowest estimated discharge for 1896 was 380 second-feet.
[b] At shoals above bridge.
[c] Boat at Second street.
[d] Made at different section.

Daily gage height, in feet, of Ocmulgee River at Macon.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1893.[a]												
1	.....	5.3	12.7	2.4	1.6	2.6	1.0	1.4	9.3	1.3	1.7	
2	.....	4.8	10.0	2.3	1.4	2.4	1.1	1.8	8.7	1.3	1.6	
3	.....	3.9	7.8	2.2	1.8	5.4	1.1	2.2	5.5	1.5	1.6	
4	.....	3.1	12.7	2.1	6.7	6.8	1.8	1.8	3.0	8.0	1.6	
5	.....	2.8	12.2	2.1	3.4	6.7	1.0	2.0	2.8	5.0	1.6	
6	.....	3.4	9.5	2.3	3.1	5.1	1.0	6.2	2.4	3.5	1.6	
7	.....	2.3	7.1	2.5	7.2	5.5	1.0	13.4	2.4	3.0	1.5	
8	.....	1.8	6.5	2.2	4.9	9.7	1.0	9.5	2.3	2.8	1.5	
9	.....	1.6	4.7	2.0	4.9	7.0	1.8	5.0	3.0	2.7	1.5	
10	.....	1.3	8.9	1.8	3.4	3.4	1.2	3.2	4.0	2.6	1.5	
11	.....	2.8	7.8	1.7	2.9	2.5	1.2	2.0	4.1	2.6	1.5	
12	.....	4.6	5.8	1.7	2.2	2.2	1.2	1.8	5.4	2.5	1.5	
13	.....	14.6	5.0	1.6	1.8	2.0	1.1	1.7	9.4	2.5	1.5	
14	.....	13.0	4.1	1.6	1.6	3.0	1.1	1.7	10.9	2.8	1.5	
15	.....	11.2	3.5	1.6	1.3	3.0	1.1	4.2	6.8	2.7	1.5	
16	.....	11.0	2.6	1.7	1.2	3.0	.9	4.0	4.0	2.5	1.5	
17	.....	13.4	3.0	1.6	1.5	2.0	.9	2.0	3.5	2.5	1.5	
18	.....	12.0	2.4	1.4	1.2	1.8	1.0	1.9	2.0	2.5	1.5	
19	.....	11.3	2.2	1.2	1.2	3.0	1.4	1.7	2.0	2.4	1.5	
20	.....	10.6	2.1	2.5	1.0	2.6	1.6	1.6	1.6	2.2	1.5	
21	2.7	6.8	.....	9.0	.8	2.3	1.7	1.6	1.6	2.1	2.0	
22	2.8	4.8	.....	7.4	.7	2.4	5.4	1.4	1.5	2.1	2.8	
23	2.8	3.3	.....	4.3	.6	2.2	2.4	1.3	1.5	2.0	3.0	
24	2.6	5.4	2.9	2.9	.7	2.2	2.2	1.3	1.5	2.0	2.8	
25	4.6	4.0	3.7	2.2	.6	2.2	2.0	1.2	1.4	2.0	2.6	
26	5.0	3.6	5.3	1.8	.6	1.0	1.8	1.2	1.4	2.0	2.4	
27	4.7	3.5	4.0	1.8	.7	1.0	1.8	1.1	1.6	2.0	2.3	
28	5.3	11.9	3.1	1.7	.4	1.0	2.0	1.2	1.5	1.8	2.1	
29	5.8	.....	2.8	1.6	.2	1.1	1.4	1.4	1.4	1.7	2.0	
30	6.3	.....	2.6	1.6	6.1	1.0	1.3	1.4	1.4	1.7	2.0	
31	6.6	.....	2.5	.....	5.6	.....	1.2	2.0	.....	1.7	.....	
1894.[b]												
1	3.2	2.3	10.4	3.0	1.8	1.2	1.8	7.0	3.4	.9	5.0	
2	3.0	2.0	9.1	3.0	1.7	1.2	1.6	6.0	3.2	.9	5.6	
3	2.8	2.0	8.6	2.5	1.5	1.2	1.4	5.8	3.0	.9	7.0	
4	2.6	3.0	8.0	2.5	1.5	1.2	1.3	4.8	2.8	.8	6.5	
5	2.3	2.8	4.9	3.0	1.5	1.2	1.2	9.0	2.6	.8	6.0	
6	2.0	2.6	4.2	2.8	1.5	1.1	2.5	14.2	3.0	.8	5.0	
7	1.8	2.4	3.9	2.8	1.5	1.1	3.0	12.2	4.0	.8	4.0	
8	1.6	2.3	3.8	2.5	1.5	1.0	2.8	9.6	6.0	.9	3.0	
9	3.7	2.2	3.7	2.5	1.5	1.0	2.6	6.9	5.5	11.0	2.8	
10	3.3	2.1	3.5	2.5	1.3	1.0	3.0	5.4	5.0	15.1	2.4	
11	4.5	3.0	3.2	5.6	1.3	.9	4.0	4.0	4.8	8.0	2.3	
12	6.0	7.2	7.1	5.2	1.3	.9	3.8	4.0	4.6	6.0	2.1	
13	6.8	10.0	7.9	5.0	1.2	.9	3.4	3.8	5.0	4.5	2.0	
14	5.5	11.0	6.0	4.6	1.5	1.0	3.2	3.6	5.8	4.3	2.0	
15	3.2	13.7	4.0	4.0	3.0	.9	3.0	3.4	4.6	4.1	1.9	
16	3.8	9.8	3.5	3.8	2.5	.9	2.8	3.1	4.3	3.9	1.8	
17	4.2	7.5	4.0	3.5	2.0	.9	3.0	3.0	4.2	3.6	1.7	
18	3.3	6.2	6.0	3.0	1.7	1.0	3.0	3.0	5.0	3.4	1.7	
19	3.0	5.7	5.0	2.8	2.5	.9	7.6	4.0	5.3	3.2	1.5	
20	2.8	5.2	4.6	6.5	2.3	.9	6.8	3.0	11.3	3.1	1.5	
21	3.0	4.9	4.3	6.0	2.0	.8	7.9	4.5	5.5	3.0	1.5	
22	3.2	5.1	4.0	5.8	1.7	2.0	4.0	4.0	3.0	2.8	1.5	
23	3.0	5.2	3.8	5.5	1.5	2.5	3.0	3.8	2.8	2.6	1.5	
24	3.6	5.6	3.5	4.0	1.3	2.6	3.0	3.6	2.6	2.4	1.4	
25	3.2	6.0	3.2	3.7	1.3	3.0	2.6	5.0	2.7	2.3	1.3	
26	3.3	8.9	6.0	3.5	1.3	2.5	2.3	4.8	2.3	2.1	1.3	
27	3.2	10.4	5.6	3.2	1.3	2.0	3.0	4.6	2.2	2.0	1.2	
28	3.0	9.5	4.0	2.0	1.3	1.8	4.0	4.2	2.1	1.8	1.2	
29	2.8	.....	3.5	2.0	1.3	1.6	3.7	4.0	1.0	1.7	1.1	
30	2.7	.....	3.2	2.0	1.3	2.0	4.0	3.8	1.0	1.6	1.0	
31	2.5	.....	3.0	.....	1.2	.....	7.2	3.6	.....	4.0	.....	

[a] 1893 record from United States Weather Bureau.
[b] 1894 and 1895 records from United States Weather Bureau.

Daily gage height, in feet, of Ocmulgee River at Macon—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1895.[a]												
1	3.5	6.0	3.0	4.6	6.0	3.8	10.9	2.8	4.4	[b] 2.0	0.5	0.5
2	3.4	6.0	4.0	4.5	5.5	3.7	10.0	2.8	4.2	1.8	.77	.5
3	3.2	5.8	10.8	4.3	4.0	3.6	7.8	2.8	4.0	1.6	.85	.65
4	3.0	5.3	10.0	4.2	3.8	3.5	11.8	4.0	5.0	1.4	.67	.62
5	3.0	5.1	6.0	4.0	3.7	3.5	10.0	6.0	4.8	1.4	.55	.54
6	2.8	4.0	4.0	4.0	3.6	3.4	9.5	5.8	4.6	1.2	.45	.51
7	2.7	4.0	5.7	3.9	3.6	3.3	9.0	5.6	4.3	1.0	.36	.44
8	2.6	3.9	10.9	11.2	3.6	3.2	13.4	5.4	4.2	1.0	.47	.4
9	3.0	3.7	8.5	11.0	3.6	3.2	10.0	5.3	4.0	1.0	.55	.46
10	15.0	3.6	6.0	8.0	5.0	3.0	7.0	5.0	3.9	.8	.63	.45
11	14.5	3.5	4.0	7.0	5.0	3.0	5.0	4 9	5.0	.6	.65	2.5
12	11.5	3.5	4.0	6.5	5.5	2.9	4.0	4.7	4.8	.7	.6	2.29
13	7.0	4.0	6.0	6.0	5.3	2.9	3.9	4.5	4.5	.65	.77	1.51
14	6.0	4.2	14.5	5.8	5.0	3.0	3.7	4.6	4.3	.4	.94	1.11
15	5.0	4.7	15.8	5.3	4.8	4.0	3.5	7.0	4.1	.3	.72	1.01
16	3.0	4.5	16.4	5.0	4.6	4.0	3.4	9.7	4.0	.2	.65	1.72
17	2.9	4.2	18.4	4.8	4.2	4.5	3.3	12.2	3.9	.2	.57	.58
18	2.7	4.1	16.8	12.5	5.0	4.3	3.2	13.0	3.7	.17	.55	.64
19	2.6	4.0	12.0	10.0	4.2	4.0	3.3	12.0	3.6	.2	.5	.61
20	2.5	3.9	9.0	8.0	4.0	3.9	3.6	9.0	3.5	.18	.5	.59
21	2.2	3.6	11.0	7.0	3.8	3.8	3.5	6.0	3.5	.25	.5	2.02
22	2.1	3.5	9.0	6.0	4.0	3.7	3.4	10.0	3.5	.22	.5	3.1
23	2.0	3.5	8.0	6.5	4.5	4.0	3.3	9.0	3.4	.21	.5	2.68
24	2.0	3.4	7.0	6.0	5.0	3.9	3.3	6.0	3.4	.21	.5	1.7
25	2.0	3.3	6.0	4.8	5.0	3.8	3.2	4.5	3.3	.17	.49	1.48
26	12.5	3.2	5.8	4.7	7.0	3.7	3.1	4.0	3.2	.19	.49	1.01
27	8.0	3.2	5.5	8.1	12.5	3.5	3.0	4.0	3.2	.18	.47	1.0
28	7.0	3.1	5.4	10.9	7.0	3.4	3.0	5.0	3.2	.18	.43	1.2
29	11.0	.....	5.3	10.0	5.0	3.2	2.9	4.0	3.1	.17	.55	1.3
30	11.0	.....	5.0	7.0	4.0	.....	2.9	4.0	3.0	.22	.54	1.35
31	7.0	.....	4.8	.....	3.9	.....	2.9	4.5	.....	.5	.....	4.46
1896.												
1	4.81	3.0	[c] 2.5	[c] 3.1	.89	.08	− .9	1.02	.11	− .82	− .14	9.5
2	3.5	2.9	2.2	3.0	.75	− .11	−1.0	1.5	.12	− .86	− .08	11.08
3	2.2	3.2	2.1	4.6	.63	.56	+ .1	1.82	.11	− .88	− .02	12.6
4	1.7	3.0	2.0	3.4	.9	.85	.15	2.22	.28	− .81	10.0	10.2
5	1.42	2.9	2.0	2.9	2.12	1.92	2.0	2.62	.19	− .75	14.2	8.0
6	1.08	13.5	1.9	1.8	2.73	1.52	4.0	3.0	.19	− .79	14.4	6.15
7	.96	10.7	4.0	1.6	1.97	.96	5.3	3.05	.19	− .78	8.8	4.52
8	1.72	7.5	6.0	1.1	1.62	.73	11.0	2.78	.12	− .82	5.4	3.62
9	2.83	13.1	5.0	1.1	.86	.25	20.0	2.41	.08	− .82	3.22	3.0
10	2.77	11.3	4.0	1.4	.61	.01	19.4	1.88	.04	− .82	2.25	2.42
11	2.1	8.7	5.0	1.3	.38	− .05	15.0	1.48	.01	− .73	1.5	1.98
12	1.6	7.0	7.2	1.1	.3	− .1	10.2	.4	− .01	− .65	1.18	1.58
13	1.5	6.3	6.5	1.2	.19	− .17	8.2	.2	− .31	− .75	10.0	1.26
14	1.2	6.5	6.2	1.2	.11	.29	7.1	.13	− .45	− .73	8.1	1.12
15	2.0	5.0	6.0	1.13	.09	.32	7.0	.25	− .8	− .65	5.32	11.7
16	2.5	4.8	6.0	1.12	.07	.2	6.2	1.08	− .68	− .77	1.53	6.0
17	7.2	4.2	5.5	1.09	.05	.25	16.0	.5	− .78	− .8	1.14	4.62
18	5.0	3.4	5.3	1.05	.03	.25	18.2	.6	− .8	− .83	.97	3.94
19	4.5	3.2	5.0	.98	− .05	.3	13.0	.38	− .82	− .85	.85	2.86
20	4.0	3.0	4.9	.94	− .1	.4	7.05	.2	− .91	− .88	.63	2.38
21	3.9	2.9	4.7	.86	− 1.	.47	3.8	.11	− .9	− .89	.7	2.0
22	3.7	2.7	4.5	.76	− .15	.56	3.2	.08	− .82	− .9	.62	1.9
23	9.4	2.6	4.2	.71	− .05	.7	3.0	− .06	− .41	− .77	.58	1.76
24	13.8	2.5	5.0	.63	.56	.6	2.9	− .05	− .48	− .4	.58	1.38
25	12.0	2.48	5.0	.63	.5	.3	2.85	.0	− .61	− .52	.51	1.18
26	9.3	2.4	4.8	1.02	.78	− .2	2.7	− .03	− .72	− .25	.51	1.11
27	7.0	2.3	4.7	2.9	.52	− .35	2.4	− .04	− .78	− .08	.5	.96
28	5.8	3.3	4.6	2.32	.34	− .65	2.1	− .07	− .83	− .2	.47	.9
29	5.3	2.8	4.4	1.36	.17	− .75	1.92	− .07	− .91	− .32	.44	.83
30	4.8	.....	4.2	1.02	.12	− .85	1.66	− .09	− .8	− .23	.32	.78
31	3.2	.....	4.1	.....	.12	.....	1.41	− .12	.....	− .18	.....	.7

[a] 1894 and 1895 records from United States Weather Bureau.
[b] From October 1 to 23, 1895, estimated by B. M. Hall.
[c] Gage heights from March 1 to April 14, 1896, supplied from Weather Bureau records.

Daily gage height, in feet, of Ocmulgee River at Macon—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1897.												
1	0.68	2.0	4.0	5.57	1.95	1.22	1.08	1.08	1.1	−0.5	−0.12	1.2
2	.63	5.0	3.7	9.75	1.9	1.18	.75	.84	1.25	− .45	+ .35	.7
3	.6	8.0	3.2	10.05	1.87	3.15	.65	.72	.68	− .5	.48	.6
4	.58	6.0	2.0	10.0	2.15	3.2	2.15	.4	.62	− .54	.35	.5
5	.56	6.0	4.0	15.12	2.23	3.12	2.3	.38	.35	− .61	.25	1.6
6	.54	8.0	3.0	15.15	2.47	3.1	3.8	.42	.28	− .68	.12	1.3
7	.52	6.5	11.6	12.6	3.0	3.0	3.12	1.4	.22	− .52	.1	1.12
8	.5	5.0	12.7	10.48	3.0	2.54	1.62	3.22	.12	− .55	.5	1.0
9	.49	4.75	7.5	10.0	2.91	2.32	1.28	1.1	.07	− .55	.2	.6
10	.49	4.55	5.0	10.8	2.72	2.26	.9	.8	.03	− .58	.2	.7
11	.51	5.0	4.8	7.8	2.57	2.18	3.1	1.6	− .1	+ .12	.3	.8
12	.49	13.5	6.0	6.4	2.45	2.08	3.33	2.0	− .5	.1	.6	.6
13	.48	12.75	17.3	5.0	3.05	2.04	1.5	1.02	− .2	.12	.3	.4
14	.53	7.0	18.0	4.7	3.15	2.01	.9	.7	− .12	.8	− .2	.9
15	.46	5.0	17.7	4.0	3.28	1.89	.3	.4	− .2	.3	− .1	1.0
16	.44	5.0	13.0	4.0	3.0	1.73	.5	.32	− .18	.1	− .18	1.2
17	.44	5.12	9.45	3.7	2.5	1.52	.22	.2	− .22	− .2	− .1	.4
18	1.15	3.0	8.25	3.5	2.22	1.45	.4	2.6	− .33	− .18	− .2	.3
19	1.5	2.75	8.2	3.2	2.09	1.37	1.48	2.28	1.6	− .2	− .2	.3
20	2.1	2.02	9.57	3.0	1.84	3.25	4.5	8.18	.2	− .02	− .1	.6
21	1.25	2.65	10.0	2.9	1.81	3.12	9.82	8.8	− .12	.0	− .08	.6
22	7.0	2.71	9.0	2.8	1.78	2.8	8.4	8.1	− .14	.2	− .13	.5
23	5.5	2.0	15.5	2.7	1.71	2.62	5.52	6.48	− .35	.18	− .1	.7
24	3.0	1.9	14.0	2.6	1.68	2.7	3.05	4.7	− .28	.1	− .5	.9
25	2.25	6.0	10.6	2.4	1.6	3.0	1.7	2.1	− .3	.05	− .2	1.0
26	2.0	10.5	8.35	2.3	1.56	3.11	1.11	1.4	− .28	.02	− .1	.9
27	3.0	7.02	7.1	2.22	1.53	2.5	1.32	1.08	− .25	− .12	+ .1	.8
28	3.12	5.0	6.4	2.16	1.5	1.0	3.22	.8	− .32	− .16	.25	1.0
29	1.5	.....	5.57	2.08	1.47	.9	2.1	.58	− .35	− .2	3.1	1.0
30	1.25	.....	5.21	2.0	1.36	1.5	1.76	.52	− .42	− .2	1.4	.5
31	1.2	.....	5.2	.....	1.28	.....	1.12	.4	.....	− .2	.....	.6
1898.												
1	.5	1.1	.25	1.75	1.87	− .53	− .82	5.11	4.96	.75	2.54	4.1
2	.45	1.01	.3	.5	1.1	− .48	− .87	3.70	14.48	.72	2.19	3.5
3	.38	1.0	.3	.48	.92	− .52	− .35	2.11	16.6	7.72	2.08	9.4
4	.32	.7	1.08	.6	.78	− .58	− .5	1.85	18.22	16.85	2.0	13.6
5	.32	.69	3.35	4.33	.6	− .7	− .78	10.5	15.76	17.32	1.85	9.7
6	.38	.71	3.3	12.1	.5	− .78	− .9	10.76	14.72	15.15	1.92	8.1
7	.45	.77	1.45	10.13	.58	− .82	+2.12	10.79	11.0	13.35	2	6.61
8	.43	.75	1.35	7.9	.58	− .87	1.35	8.72	9.4	11.75	2.03	6.03
9	.41	.67	1.1	4.37	.47	− .8	.93	4.91	6.9	9.21	1.9	5.21
10	.43	.6	.8	3.92	.3	− .83	3.48	2.7	6.11	7.35	1.83	5.8
11	.58	.6	.75	2.9	.21	− .94	3.62	6.31	4.0	5.02	2.91	4.21
12	.75	.52	.6	2.74	.18	− .95	1.22	12.7	3.65	4.1	3.37	3.64
13	1.63	.5	.6	2.1	.2	− .96	.9	13.0	3.8	3.5	4.22	3.6
14	1.3	.48	.6	1.75	.18	+ .1	1.2	12.97	2.8	3.07	6.41	3.42
15	.9	.36	2.0	1.6	.1	.53	3.2	9.12	2.5	2.85	6.23	3.21
16	.94	.32	3.92	1.5	.04	− .1	3.8	6.52	1.93	2.56	14.1	2.91
17	.83	.25	3.0	1.2	− .08	− .1	2.67	4.92	1.89	2.3	10.21	2.6
18	.76	.4	2.02	.98	− .15	− .38	1.6	5.41	1.72	4.12	9.27	2.7
19	.6	.63	1.49	.85	− .2	+ .11	.7	2.7	1.56	4.38	12.31	3.11
20	.66	.72	1.22	1.02	− .1	.83	.2	4.1	1.3	4.18	9.02	3.0
21	1.45	.64	.95	1.6	− .15	.6	− .11	2.1	1.22	5.21	6.95	4.1
22	1.85	.5	.85	1.32	+ .05	2.21	− .28	1.94	1.48	6.9	5.5	5.6
23	1.56	.4	.75	1.3	.11	.2	− .32	1.9	1.42	5.23	5.15	3.6
24	1.1	.33	.5	7.95	.91	.41	+3.32	1.42	1.35	4.17	4.31	5.32
25	1.22	.29	.5	8.9	1.52	− .5	2.51	.9	1.31	3.94	4.0	4.91
26	2.7	.25	.45	6.12	1.46	− .53	5.35	.5	1.28	3.2	4.5	4.8
27	5.37	.23	.39	3.15	1.1	+ .3	3.3	4.25	1.12	2.91	3.18	4.05
28	4.31	.22	.36	2.9	.32	.51	3.1	7.21	.98	2.43	2.92	3.8
29	2.5	.....	.39	2.55	− .11	− .42	3.14	9.45	.83	2.32	3.5	3.3
30	2.08	.....	.5	2.05	− .3	− .65	4.3	7.53	.77	2.9	3.31	3.21
31	1.62	.....	1.5	.....	− .36	.....	9.02	5.08	.....	2.71	.....	3.1
1899.												
1	4.42	9.6	14.72	11.3	4.05	4.4	1.5	2.5	2.6	.3	.8	1.7
2	6.6	8.41	11.14	8.71	3.8	2.8	1.5	2.1	1.8	.3	.6	1.5
3	5.96	13.7	9.11	7.97	3.6	2.6	1.2	1.4	2.0	.3	.6	1.2
4	5.21	11.98	8.32	7.86	3.5	2.6	.9	1.4	1.8	.4	.5	2.1
.....	3.7	9.94	8.11	8.11	3.45	1.9	.9	1.2	1.8	.5	.5	1.9

Daily gage height, in feet, of Ocmulgee River at Macon—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
.....	4.12	10.8	7.62	7.85	8.1	1.8	1.0	1.0	1.1	2.3	0.5	1.5
.....	15.2	15.83	6.81	6.89	6.72	1.6	1.1	.8	.7	2.0	.4	1.3
.....	12.65	13.42	6.72	6.5	5.3	1.6	1.5	.7	.7	10.0	.4	1.1
.....	10.21	12.13	6.4	5.97	3.8	1.6	2.0	.6	.5	6.4	.4	1.1
.....	9.23	10.8	6.11	5.63	3.55	1.4	1.3	.5	.4	3.2	.4	1.0
.....	12.14	9.78	5.81	5.42	3.28	1.6	1.1	2.1	2.2	2.2	.4	1.1
.....	11.87	8.21	5.74	5.01	3.1	1.5	.9	1.0	2.5	1.8	.5	3.7
.....	9.38	7.6	5.69	4.71	2.96	2.3	.8	1.2	2.2	1.3	.5	4.7
.....	8.96	7.13	5.58	4.58	2.9	2.9	.8	.8	1.7	1.0	.5	3.9
.....	8.21	6.1	5.51	4.4	2.82	2.2	.7	.7	.9	1.0	.8	2.6
.....	9.67	12.3	8.51	5.01	2.69	1.7	.6	.7	.6	.9	.7	2.0
.....	12.91	11.98	7.21	4.42	2.52	1.5	.6	.6	.6	.8	.7	1.8
.....	10.87	11.12	9.38	4.33	2.45	2.3	.5	.6	.5	.8	.7	1.5
.....	9.34	9.76	12.94	10.38	2.33	1.4	.7	.5	.5	.8	.6	1.4
.....	5.91	8.32	10.72	7.82	2.2	1.3	.9	.4	.4	2.0	.6	1.4
.....	5.11	8.27	9.42	5.52	2.18	1.3	1.0	.4	.3	2.8	.6	1.3
.....	5.42	8.16	8.11	4.72	2.48	1.2	.8	a.0	.3	3.2	.5	1.3
.....	5.1	8.1	6.42	4.61	3.67	1.0	1.3	3.3	.3	2.4	.6	1.4
.....	5.37	7.13	8.65	5.48	3.35	.9	3.2	3.1	.2	1.6	1.0	6.4
.....	5.31	6.28	8.85	11.87	3.01	.9	2.0	2.1	.2	1.2	1.4	5.9
.....	5.01	6.13	6.93	12.41	2.4	1.2	2.0	1.2	.4	1.0	4.4	5.2
.....	4.71	12.13	6.01	8.22	2.18	3.2	2.3	.8	.4	.8	5.3	3.5
.....	4.69	14.91	7.87	5.84	2.12	3.2	4.3	3.0	.4	.7	4.2	2.6
.....	5.03	.....	7.3	5.16	2.06	1.6	5.1	2.3	.3	1.4	3.1	2.3
.....	4.9	.....	6.91	4.71	2.03	1.7	4.2	1.8	.3	1.0	2.0	2.1
.....	5.07	.....	6.28	.....	2.15	.....	3.2	2.4	.....	1.1	.....	1.6
1900.												
.....	1.6	1.6	9.2	5.2	6.1	2.9	9.6	6.1	10.5	1.8	2.0	2.7
.....	1.5	1.5	9.4	4.9	7.3	2.9	8.3	4.4	5.8	1.8	3.2	2.6
.....	1.2	1.5	7.7	4.8	8.6	3.2	13.3	4.2	5.0	1.7	2.8	2.5
.....	1.2	1.5	6.2	4.6	8.0	3.8	11.2	3.7	3.5	2.2	12.3	8.4
.....	1.2	2.8	5.8	4.5	7.3	4.6	8.3	3.4	2.7	4.1	8.2	11.5
.....	1.5	2.9	5.5	4.5	6.4	6.4	6.4	3.1	2.5	3.6	4.9	9.3
.....	1.4	2.5	5.3	4.3	5.6	8.0	5.5	3.0	2.4	5.0	3.6	6.4
.....	1.4	2.3	7.0	4.3	4.4	8.9	4.9	2.8	2.1	4.6	3.2	4.8
.....	1.3	3.2	7.8	4.1	4.1	7.7	5.0	2.6	2.2	2.7	2.8	4.2
.....	1.3	8.3	9.7	4.1	4.1	6.6	4.5	2.5	2.1	3.2	2.6	3.7
.....	1.9	16.1	8.1	4.3	4.1	5.5	4.3	2.4	2.0	2.6	2.5	3.3
.....	2.9	18.7	6.4	7.0	4.0	5.2	4.8	2.3	2.0	2.5	2.4	3.2
.....	4.2	19.0	5.8	7.6	3.9	3.8	5.3	2.4	1.8	2.4	2.3	3.0
.....	3.7	21.7	5.3	6.1	3.8	3.7	3.9	2.6	1.7	2.7	2.2	8.5
.....	2.6	19.5	5.3	5.3	3.6	3.2	4.5	2.4	4.7	2.6	2.2	12.5
.....	2.2	15.5	10.4	4.8	3.4	8.6	4.0	2.4	13.3	2.4	2.2	8.5
.....	2.0	11.4	7.3	4.3	3.4	8.8	3.9	2.6	10.5	2.2	2.1	4.6
.....	2.0	8.5	5.8	5.0	3.3	10.9	3.7	2.7	6.0	2.1	2.1	4.4
.....	2.9	7.4	5.2	18.0	4.1	11.2	3.5	2.7	4.0	2.0	2.1	3.9
.....	3.8	6.8	8.0	15.6	4.0	8.0	3.5	2.6	3.3	1.9	2.0	4.0
.....	4.6	8.2	7.7	13.9	3.7	5.3	3.4	2.4	2.7	1.9	2.4	12.8
.....	3.9	8.9	6.6	16.0	3.5	4.0	3.3	2.3	2.5	1.9	2.4	12.1
.....	3.1	7.7	5.6	13.9	3.3	4.0	3.4	2.2	2.4	2.1	2.5	8.6
.....	2.7	6.4	7.3	13.2	4.6	16.0	3.9	3.6	2.3	8.3	2.7	6.5
.....	2.5	7.3	7.9	13.0	4.8	20.2	3.4	4.1	2.3	4.2	2.5	5.5
.....	2.2	6.5	10.5	12.4	4.2	20.0	3.3	4.3	2.2	3.7	7.1	4.8
.....	2.0	5.9	10.9	9.8	3.8	16.4	4.2	3.8	2.0	2.9	5.5	4.1
.....	2.0	5.5	7.8	7.6	3.3	14.0	4.5	2.7	2.0	2.5	4.3	3.9
.....	1.9	.....	7.4	7.0	3.1	12.7	5.6	2.4	2.0	2.4	3.2	3.7
.....	1.7	.....	6.6	6.3	3.0	10.4	6.3	2.3	1.9	2.3	2.9	3.8
.....	1.6	.....	5.8	.....	2.9	.....	8.0	3.8	.....	2.1	.....	7.5
1901.												
.....	11.7	4.7	4.1	14.5	4.2	9.9	5.3	3.8	5.4	3.4	1.7	1.9
.....	12.3	5.0	4.0	9.5	4.1	8.5	5.5	3.0	7.5	3.3	1.7	1.9
.....	13.7	4.5	3.9	18.8	4.0	6.2	5.7	2.5	4.8	5.3	1.7	2.0
.....	11.9	14.9	3.8	17.3	3.9	5.4	3.8	2.2	4.4	5.6	1.7	1.9
.....	9.5	15.9	3.8	13.1	3.9	5.1	3.2	2.2	3.4	3.9	2.0	3.2

a Mud around gage, August 22, 1899.

Daily gage height, in feet, of Ocmulgee River at Macon—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	No
1901.											
6	7.7	13.7	3.7	10.5	4.0	4.3	3.0	3.8	3.1	3.3	2
7	6.5	10.1	3.5	9.0	3.9	4.7	2.9	9.4	3.0	3.0	2
8	5.7	8.7	3.4	7.7	3.8	6.8	3.2	7.4	2.8	2.8	2
9	5.1	12.1	3.4	6.7	3.7	5.3	3.1	4.4	2.6	2.7	1.
10	4.8	11.3	3.5	6.1	3.6	4.0	3.0	3.0	2.5	2.6	2.
11	4.6	9.5	5.8	5.7	3.5	3.5	3.8	3.8	2.4	2.6	2.
12	5.8	7.9	6.9	5.4	3.4	3.3	2.9	8.2	2.4	2.5	1.
13	12.6	7.4	5.4	5.6	3.4	3.8	2.7	5.0	2.3	3.0	1.
14	12.0	6.5	5.0	8.5	3.5	6.0	2.6	4.4	2.6	2.9	2.
15	8.6	5.8	4.2	10.4	3.5	6.9	2.5	3.4	3.2	2.8	2.
16	7.2	5.4	3.8	10.2	3.3	9.6	3.7	5.9	2.9	2.6	2.
17	11.4	5.1	3.6	8.3	3.2	8.8	4.0	14.6	5.0	2.5	1.
18	11.2	4.9	3.4	6.8	3.1	7.5	3.5	11.6	17.7	2.3	1.
19	7.8	4.7	3.4	6.5	3.0	9.2	4.0	7.4	16.2	2.2	2.
20	6.1	4.6	3.3	7.7	3.3	6.6	15.4	7.0	12.0	2.0	2.
21	4.3	4.4	3.7	7.8	5.5	5.2	8.5	7.8	7.8	1.9	2.
22	5.0	4.2	3.9	6.5	12.0	4.6	5.5	5.2	6.0	2.1	2.
23	4.5	4.2	3.6	5.8	13.9	5.1	4.0	10.0	4.7	2.0	2.
24	4.4	4.4	3.8	5.5	9.2	5.3	3.5	14.4	3.9	2.0	2.
25	4.8	4.5	4.4	5.2	5.7	4.7	2.8	12.0	3.5	1.9	2.
26	5.1	4.6	16.1	5.0	5.0	3.3	2.6	7.2	3.3	1.9	2.
27	4.5	4.6	16.1	4.8	5.3	5.3	2.5	4.8	3.1	1.9	2.
28	5.0	4.4	13.2	4.6	4.7	5.1	2.9	10.0	3.1	1.8	2.
29	5.1	.....	9.4	4.5	4.1	4.3	3.1	10.4	3.7	1.8	1.
30	4.5	.....	7.2	4.3	3.8	5.4	3.1	9.6	3.9	1.7	1.
31	5.3	.....	15.8	.....	4.7	.....	3.0	7.4	.....	1.7	.....
1902.											
1	15.7	11.5	22.8	12.8	5.8	4.2	3.3	3.9	4.0	5.0	3.
2	11.0	18.0	20.9	10.4	5.7	4.1	3.2	3.8	3.6	5.6	3.
3	8.1	19.2	17.3	8.8	5.7	4.5	3.3	3.7	3.5	4.5	3.
4	6.3	18.5	13.0	8.5	5.8	4.3	3.1	5.5	3.3	3.9	3.
5	5.2	15.0	11.1	8.2	5.5	4.1	3.3	5.9	3.4	4.3	3.
6	4.7	10.6	10.1	7.9	5.4	4.0	3.3	9.5	3.4	5.2	3.
7	4.4	8.4	9.4	7.6	5.3	4.0	3.3	5.5	3.4	4.8	3.
8	4.2	7.2	8.7	10.5	5.2	6.2	3.2	4.6	3.3	4.2	3.
9	4.0	6.4	8.4	10.2	5.2	6.1	3.3	4.0	3.4	3.8	3.
10	3.9	5.8	8.2	9.8	5.5	5.0	3.2	3.8	3.4	3.7	3.
11	3.7	5.5	7.9	7.7	5.5	4.6	3.2	3.7	3.8	3.5	3.
12	3.6	5.3	7.7	7.3	5.3	4.2	3.3	3.4	3.6	3.9	3.
13	3.5	5.0	7.5	7.1	5.2	4.1	3.2	4.6	3.5	4.6	3.
14	3.3	4.9	8.4	6.9	5.1	4.0	3.2	4.0	3.3	4.6	3.
15	3.1	5.1	9.4	6.9	5.0	4.0	5.2	3.8	4.2	4.3	3.
16	3.1	5.5	10.7	6.9	5.4	5.8	4.1	4.1	3.8	3.9	3.
17	3.2	5.7	18.6	6.8	6.4	5.0	4.0	5.9	3.5	3.6	3.
18	3.1	5.4	16.8	11.1	5.7	4.5	3.8	4.1	3.3	3.5	3.
19	3.1	5.3	13.4	9.0	5.7	4.8	3.6	3.4	3.3	3.4	4.
20	3.2	5.2	11.0	7.6	5.7	4.4	3.4	3.7	3.2	3.4	4.
21	3.4	5.9	9.4	7.1	5.2	4.2	3.4	3.4	4.2	3.3	3.
22	3.9	6.3	8.9	7.0	5.0	4.0	3.4	3.3	4.1	3.5	3.
23	4.2	5.9	8.6	6.6	4.8	3.8	3.8	3.7	3.7	3.2	3.
24	3.7	5.3	8.2	6.4	4.7	3.7	3.5	3.6	3.6	3.2	3.
25	3.4	7.2	9.1	6.3	4.6	3.7	3.6	3.3	3.4	3.1	3.
26	3.4	8.1	8.9	6.2	4.6	3.6	3.5	3.2	6.8	3.1	8.
27	3.4	8.4	8.3	6.2	4.5	3.6	4.8	3.2	5.8	3.8	8.
28	3.4	19.9	10.0	6.1	4.4	3.5	3.7	3.3	5.3	5.4	5.
29	3.3	.....	16.2	5.9	4.3	3.4	4.9	4.3	5.4	4.7	4.
30	3.9	.....	17.3	5.8	4.2	3.4	4.7	4.6	5.2	3.9	4.
31	4.4	.....	14.6	.....	4.2	.....	4.2	4.7	.....	3.6	.....
1903.											
1	4.8	4.2	14.3	14.3	5.3	7.2	4.4	4.1	2.9	2.3	2.
2	4.5	4.0	12.3	11.4	5.1	13.5	4.3	3.5	2.7	2.3	2.
3	4.7	4.0	9.3	9.9	5.2	11.5	4.4	3.7	2.6	2.4	2.
4	4.7	4.3	8.3	9.0	6.1	9.4	4.6	5.6	2.4	2.4	2.
5	5.2	5.7	9.5	8.9	6.6	12.9	4.9	6.3	2.0	2.4	3.
6	4.9	7.8	10.0	8.1	6.4	17.4	4.4	7.4	2.5	2.5	4.
7	4.6	6.7	8.8	8.3	5.8	12.9	4.4	5.5	2.3	2.5	3.
8	4.4	20.0	7.8	7.7	7.0	12.3	4.9	3.9	2.2	2.5	3.
9	4.2	20.7	7.7	12.2	6.5	8.8	6.0	3.5	2.2	2.6	2.
10	4.0	18.4	12.6	13.0	6.0	8.2	5.6	3.4	2.1	2.6	2.

Daily gage height, in feet, of Ocmulgee River at Macon—Continued.

ıy.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
03.												
.....	3.9	15.75	11.2	10.0	5.5	6.9	4.5	3.2	2.1	2.5	2.6	3.3
.....	4.9	17.6	11.4	8.9	5.3	6.4	7.3	3.1	2.1	2.4	2.5	3.2
.....	5.4	16.3	11.2	7.7	5.1	5.8	6.6	3.5	2.2	2.3	2.9	2.9
.....	4.9	12.9	9.3	8.9	5.3	5.3	10.2	3.6	2.2	2.4	2.8	2.9
.....	4.4	10.6	8.1	8.8	7.2	5.1	11.0	5.9	9.9	2.4	2.7	3.2
.....	4.2	10.2	9.2	7.7	11.0	4.7	7.4	7.3	14.7	2.3	2.8	2.9
.....	4.2	16.3	8.7	6.9	8.2	4.5	5.3	7.3	13.0	2.9	2.7	2.7
.....	4.1	16.5	7.5	6.6	6.3	4.4	4.6	5.7	8.3	4.9	2.9	2.7
.....	3.9	14.1	6.9	6.3	5.7	4.4	4.3	9.8	5.5	3.5	2.9	2.6
.....	3.8	11.1	6.5	6.2	5.2	4.2	4.2	11.2	4.4	3.1	3.1	2.4
.....	3.8	9.4	6.4	8.2	5.1	4.1	3.9	5.7	3.8	2.9	3.0	2.9
.....	3.8	7.9	11.5	7.3	4.9	4.4	3.9	5.1	3.6	2.7	2.9	3.2
.....	3.8	7.3	15.2	6.2	4.7	4.5	3.6	4.1	3.3	2.4	2.7	3.1
.....	3.8	6.9	18.3	5.8	4.9	4.4	3.5	4.3	3.2	2.4	2.8	2.9
.....	4.0	6.3	18.3	5.7	4.5	4.2	3.4	4.0	3.2	2.4	2.8	2.6
.....	4.1	6.2	15.6	6.6	4.3	4.0	3.4	3.2	3.1	2.3	2.7	3.7
.....	4.8	6.1	11.3	6.5	4.2	4.2	3.3	3.1	3.0	2.3	2.6	3.4
.....	5.1	8.0	9.2	5.9	4.7	5.3	3.2	2.9	3.0	2.3	2.6	3.4
.....	5.1	.....	8.3	5.6	5.3	6.7	3.4	2.8	2.7	2.3	2.6	3.2
.....	5.3	.....	14.5	5.4	4.7	5.4	3.2	2.7	2.5	2.3	2.5	2.8
.....	4.7	.....	16.1	.....	4.6	.....	5.3	2.7	.....	2.3	.....	2.7
04.												
.....	2.5	3.5	4.2	3.1	2.8	3.9	1.9	3.5	1.8	.0	.0	1.0
.....	2.5	3.5	4.1	3.0	2.8	4.8	1.9	2.3	1.7	— .3	— .1	1.1
.....	2.1	3.6	4.2	3.1	2.8	3.4	2.0	2.9	1.4	[a]— .5	.2	2.4
.....	2.8	3.3	4.4	3.0	2.7	3.3	1.2	4.4	1.0	[a]— .8	.7	1.8
.....	2.7	3.2	4.2	2.9	2.7	1.9	.9	5.3	1.0	[a]—1.0	1.6	2.0
.....	2.6	3.1	3.8	2.8	2.6	1.7	1.7	3.4	4.7	— .2	1.5	5.1
.....	2.4	3.2	6.1	3.0	2.5	1.5	1.2	2.4	3.0	.2	1.4	6.0
.....	2.4	8.3	7.3	3.2	2.6	2.0	1.2	10.0	2.0	.1	.9	4.4
.....	2.6	7.5	7.1	5.7	3.6	4.3	1.0	11.1	1.6	.0	.9	3.3
.....	2.7	6.5	5.7	5.1	3.3	3.3	.7	15.4	1.5	— .1	.8	2.5
.....	3.1	10.3	5.1	3.9	3.7	2.0	1.0	13.0	1.4	.0	.8	2.3
.....	3.3	9.7	4.6	3.1	3.0	1.5	1.0	9.7	1.3	— .1	.5	2.0
.....	3.2	7.9	4.2	3.2	2.8	1.3	1.9	6.7	1.3	— .1	.9	2.0
.....	3.2	6.1	4.1	3.1	2.7	1.1	1.7	3.7	1.1	.1	1.3	1.9
.....	3.3	5.2	4.2	3.0	2.6	1.0	1.7	6.7	1.0	— .1	1.8	1.9
.....	3.2	4.8	5.0	2.9	2.5	1.0	1.2	5.4	1.0	— .2	1.8	2.0
.....	3.5	4.5	4.3	3.0	2.4	.9	1.0	5.3	.9	— .3	1.3	1.9
.....	4.5	4.2	3.9	2.8	2.3	.9	1.1	4.9	.8	— .1	1.0	2.0
.....	4.2	3.8	3.7	2.8	2.2	1.1	1.4	3.5	.8	— .3	.9	1.8
.....	3.5	4.1	3.7	3.0	2.1	.9	1.9	2.5	.7	— .3	1.0	1.8
.....	3.2	5.8	3.6	3.0	2.0	.8	1.3	2.0	.5	.0	.9	1.7
.....	3.1	7.0	3.4	2.9	1.9	4.3	1.3	1.8	1.7	— .3	.9	1.5
.....	12.9	10.3	3.6	2.9	1.8	3.4	1.1	1.7	.6	— .2	1.0	1.4
.....	10.2	9.3	3.9	2.9	1.7	2.0	1.4	1.7	.9	.4	1.5	1.4
.....	6.9	7.2	4.0	2.9	1.6	1.4	2.7	7.0	.6	.2	2.1	1.5
.....	5.0	5.4	3.7	2.8	1.6	1.0	2.2	5.3	.4	.3	1.8	1.7
.....	4.3	5.2	3.6	2.8	1.5	.8	1.2	6.3	.3	.3	1.3	2.0
.....	3.8	4.7	3.8	3.0	1.4	.8	1.1	4.8	.3	.2	1.2	6.4
.....	3.7	4.3	4.3	3.0	1.3	1.3	.8	3.3	.2	.0	1.0	5.5
.....	3.6	.....	3.2	2.9	1.3	3.0	1.7	2.9	.1	.1	1.0	4.7
.....	3.5	.....	3.0	.....	1.8	.....	4.6	2.0	.....	— .1	.....	3.3
05.												
.....	2.7	2.1	4.2	2.2	2.9	2.1	3.0	.8	.7	.6	.7	.8
.....	2.3	2.1	3.9	2.2	2.4	1.8	6.7	.7	1.7	1.0	.6	.8
.....	2.4	2.0	3.6	2.3	2.7	1.6	7.9	.8	2.4	1.2	.4	1.7
.....	2.4	1.9	3.4	2.2	4.4	2.3	7.5	.6	2.2	2.9	.43	13.0
.....	2.1	2.0	3.3	2.4	4.6	2.0	5.0	.4	2.2	2.0	.44	15.0
.....	2.0	2.3	3.2	3.3	4.4	1.6	3.5	.0	1.5	1.5	.37	10.4
.....	2.2	3.2	3.0	3.3	3.6	1.4	3.9	— .1	1.3	1.15	.32	6.7
.....	2.7	6.2	3.0	3.0	3.8	1.3	4.5	— .1	.8	.75	.65	5.1
.....	3.0	13.3	3.0	2.7	3.4	1.1	3.9	2.2	.4	.3	.62	6.9
.....	2.4	11.4	3.7	3.3	3.0	1.0	3.2	4.4	.2	.27	.85	11.6

[a] See footnote to estimated monthly discharge, 1904.

Daily gage height, in feet, of Ocmulgee River at Macon—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
11	2.1	10.3	3.4	5.3	2.7	0.8	3.7	3.5	—.1	0.24	3.3	11.2
12	1.9	10.7	4.6	4.3	2.3	.7	6.7	3.4	—.2	.8	4.2	8.3
13	5.3	10.4	5.7	6.3	2.0	.9	6.6	10.6	—.3	1.3	3.4	6.7
14	9.0	15.4	5.0	4.6	1.8	1.7	8.2	7.4	.6	1.5	2.3	4.9
15	7.9	12.7	4.4	3.0	1.7	1.1	6.7	6.2	.2	1.2	1.55	4.9
16	5.0	10.2	3.9	4.1	2.4	1.8	3.3	6.3	.2	.7	1.7	5.3
17	4.1	7.7	3.5	3.3	4.0	3.8	2.7	4.2	.0	.45	1.35	5.4
18	3.8	6.4	3.3	3.1	2.5	2.2	2.3	3.5	—.2	.51	1.2	4.4
19	3.1	5.8	3.0	2.7	2.2	1.7	1.7	3.2	—.3	.43	1.12	4.1
20	3.0	5.3	3.0	2.4	1.8	1.4	1.6	1.9	—.4	.36	1.1	4.9
21	2.9	8.0	5.6	2.2	1.7	1.1	1.8	1.5	—.5	.34	.6	14.7
22	2.9	9.6	4.3	2.2	1.6	1.1	1.8	1.3	—.5	.26	.6	15.1
23	2.8	9.1	4.2	2.1	4.0	4.8	1.3	1.2	—.5	.16	.8	12.4
24	2.5	7.3	3.5	2.1	3.8	3.9	1.2	2.3	—.6	.18	.7	10.5
25	2.4	6.1	3.4	2.1	4.9	3.2	.9	2.9	—.3	.12	.6	9.4
26	2.2	5.6	3.3	2.0	4.4	2.3	1.2	2.3	—.2	.9	.6	7.9
27	1.9	5.0	3.2	2.0	3.5	1.8	2.1	1.5	—.3	1.3	.7	5.9
28	1.7	4.5	2.9	2.0	3.0	1.4	1.7	1.2	—.4	1.1	.9	4.7
29	2.0	.....	2.7	2.0	2.9	2.5	1.2	1.1	—.3	1.25	1.1	6.4
30	2.0	.....	2.5	2.2	2.9	2.5	1.1	.9	—.2	1.1	.9	5.9
31	2.0	.....	2.4	.....	2.5	.....	1.0	1.4	.....	.74	.....	4.9

Rating tables for Ocmulgee River at Macon.

JANUARY 1, 1893, TO DECEMBER 31, 1896.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*
0.00	380	1.20	1,285	3.40	2,240	7.40	5,060
.80	426	1.30	1,328	3.60	2,330	7.60	5,290
.70	469	1.40	1,371	3.80	2,420	7.80	5,520
.60	512	1.50	414	4.00	2,525	8.00	5,750
.50	555	1.60	457	4.20	2,630	8.50	6,500
.40	598	1.70	1,500	4.40	2,740	9.00	7,250
.30	641	1.80	1,543	4.60	2,860	9.50	7,925
.20	684	1.90	1,586	4.80	2,970	10.00	8,625
.10	727	2.00	1,629	5.00	3,090	10.50	9,450
.00	770	2.10	1,672	5.20	3,210	11.00	10,300
+ .10	813	2.20	1,715	5.40	3,340	11.50	11,125
.20	855	2.30	1,758	5.60	3,460	12.00	11,975
.30	898	2.40	1,801	5.80	3,600	13.00	14,000
.40	941	2.50	1,844	6.00	3,750	14.00	16,750
.50	984	2.60	1,887	6.20	3,900	15.00	19,750
.60	1,027	2.70	1,920	6.40	4,070	16.00	23,000
.70	1,070	2.80	1,963	6.60	4,240	17.00	26,200
.80	1,113	2.90	2,006	6.80	4,430	18.00	29,375
.90	1,156	3.00	2,050	7.00	4,600	19.00	32,750
1.00	1,200	3.20	2,150	7.20	4,830	20.00	36,200
1.10	1,242						

JANUARY 1 TO DECEMBER 31, 1897.[a]

—.60	450	2.00	1,604	5.40	3,351	8.80	6,120
—.50	481	2.20	1,698	5.60	3,474	9.00	6,430
—.40	516	2.40	1,793	5.80	3,598	9.50	7,450
—.30	554	2.60	1,888	6.00	3,722	10.00	8,700
—.20	594	2.80	1,985	6.20	3,846	10.50	9,950
—.10	636	3.00	2,083	6.40	3,975	11.00	11,200
.00	680	3.20	2,182	6.60	4,109	11.50	12,450
.10	726	3.40	2,280	6.80	4,251	12.00	13,700
.20	772	3.60	2,379	7.00	4,400	12.50	14,950
.40	864	3.80	2,478	7.20	4,554	13.00	16,200
.60	956	4.00	2,577	7.40	4,716	13.50	17,450
.80	1,048	4.20	2,676	7.60	4,884	14.00	18,700
1.00	1,140	4.40	2,779	7.80	5,053	15.00	21,200
1.20	1,232	4.60	2,886	8.00	5,225	16.00	23,700
1.40	1,324	4.80	2,997	8.20	5,408	17.00	26,200
1.60	1,416	5.00	3,112	8.40	5,616	18.00	28,700
1.80	1,510	5.20	3,230	8.60	5,850		

[a] Above gage height 10.0 feet the rating curve is a tangent, the difference being 250 per tenth.

Rating tables for Ocmulgee River at Macon—Continued.

JANUARY 1 TO DECEMBER 31, 1898.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*
−1.00	370	0.80	1,060	2.60	1,960	5.80	3,720
−.90	388	.90	1,105	2.70	2,015	6.00	3,830
−.80	440	1.00	1,150	2.80	2,070	6.50	4,110
−.70	475	1.10	1,195	2.90	2,125	7.00	4,410
−.60	510	1.20	1,240	3.00	2,180	7.50	4,715
−.50	550	1.30	1,285	3.20	2,290	8.00	5,060
−.40	580	1.40	1,330	3.40	2,400	8.50	5,440
−.30	620	1.50	1,380	3.60	2,510	9.00	5,880
−.20	660	1.60	1,430	3.80	2,620	9.50	6,340
−.10	700	1.70	1,480	4.00	2,730	10.00	6,900
.00	740	1.80	1,530	4.20	2,840	11.00	8,800
.10	780	1.90	1,580	4.40	2,950	12.00	11,800
.20	820	2.00	1,630	4.60	3,060	13.00	15,000
.30	860	2.10	1,685	4.80	3,170	14.00	18,200
.40	900	2.20	1,740	5.00	3,280	15.00	21,400
.50	940	2.30	1,795	5.20	3,390	16.00	24,600
.60	980	2.40	1,850	5.40	3,500	17.00	27,800
.70	1,020	2.50	1,905	5.60	3,610	18.00	31,000

JANUARY 1 TO DECEMBER 31, 1899.

0.20	580	2.00	1,360	3.80	2,440	7.20	4,480
.30	600	2.10	1,420	3.90	2,500	7.40	4,600
.40	620	2.20	1,480	4.00	2,560	7.60	4,720
.50	650	2.30	1,540	4.20	2,680	7.80	4,860
.60	690	2.40	1,600	4.40	2,800	8.00	5,010
.70	730	2.50	1,660	4.60	2,920	8.50	5,410
.80	770	.60	1,720	4.80	3,040	9.00	5,810
.90	810	2.70	1,780	5.00	3,160	9.50	6,250
1.00	850	2.80	1,840	5.20	3,280	10.00	6,820
1.10	895	2.90	1,900	5.40	3,400	10.50	7,450
1.20	940	3.00	1,960	5.60	3,520	11.00	8,120
1.30	990	3.10	2,020	5.80	3,640	11.50	8,935
1.40	1,040	3.20	2,080	6.00	3,760	12.00	10,010
1.50	1,090	3.30	2,140	6.20	3,880	13.00	12,900
1.60	1,140	3.40	2,200	6.40	4,000	14.00	16,000
1.70	1,195	3.50	2,260	6.60	4,120	15.00	19,200
1.80	1,250	3.60	2,320	6.80	4,240	16.00	22,400
1.90	1,305	3.70	2,380	7.00	4,360		

JANUARY 1 TO DECEMBER 31, 1900.[b]

10.00	6,820	12.50	10,300	15.00	18,100	20.00	39,100
10.50	7,420	13.00	11,240	16.00	22,300	21.00	43,300
11.00	8,020	13.50	12,470	17.00	26,500	22.00	47,500
11.50	8,645	14.00	13,900	18.00	30,700	23.00	51,700
12.00	9,400	14.50	16,000	19.00	34,900		

JANUARY 1 TO DECEMBER 31, 1901.[c]

1.70	978	3.10	1,594	4.50	2,365	6.80	3,940
1.80	1,019	3.20	1,643	4.60	2,426	7.00	4,090
1.90	1,059	3.30	1,693	4.70	2,488	7.20	4,243
2.00	1,100	3.40	1,744	4.80	2,551	7.40	4,398
2.10	1,142	3.50	1,796	4.90	2,615	7.60	4,556
2.20	1,184	3.60	1,849	5.00	2,680	7.80	4,717
2.30	1,227	3.70	1,903	5.20	2,811	8.00	4,880
2.40	1,270	3.80	1,958	5.40	2,945	8.20	5,047
2.50	1,314	3.90	2,014	5.60	3,081	8.40	5,218
2.60	1,359	4.00	2,070	5.80	3,219	8.60	5,395
2.70	1,405	4.10	2,127	6.00	3,360	8.80	5,579
2.80	1,451	4.20	2,185	6.20	3,502	9.00	5,770
2.90	1,498	4.30	2,244	6.40	3,646	9.50	6,265
3.00	1,546	4.40	2,304	6.60	3,792	10.00	6,820

[a] Above gage height 12.0 feet the rating curve is a tangent, the difference being 320 per tenth.
[b] Below gage height 10.0 feet this table is the same as the 1899 table.
[c] Above gage height 10.0 feet this table is the same as the 1900 table.

Rating tables for Ocmulgee River at Macon—Continued.

JANUARY 1 TO DECEMBER 31, 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*
3.10	800	4.40	1,685	5.70	2,700	7.80	4,565
3.20	865	4.50	1,760	5.80	2,780	8.00	4,755
3.30	930	4.60	1,835	5.90	2,865	8.20	4,945
3.40	995	4.70	1,910	6.00	2,950	8.40	5,140
3.50	1,060	4.80	1,985	6.20	3,120	8.60	5,340
3.60	1,125	4.90	2,060	6.40	3,290	8.80	5,540
3.70	1,190	5.00	2,140	6.60	3,460	9.00	5,740
3.80	1,260	5.10	2,220	6.80	3,640	9.20	5,945
3.90	1,330	5.20	2,300	7.00	3,820	9.40	6,155
4.00	1,400	5.30	2,380	7.20	4,000	9.60	6,370
4.10	1,470	5.40	2,460	7.40	4,185	9.80	6,590
4.20	1,540	5.50	2,540	7.60	4,375	10.00	6,820
4.30	1,610	5.60	2,620				

JANUARY 1 TO DECEMBER 31, 1903.[b]

2.00	810	3.30	1,505	5.20	2,640	7.80	4,290
2.10	860	3.40	1,560	5.40	2,760	8.00	4,420
2.20	910	3.50	1,620	5.60	2,880	8.50	4,770
2.30	960	3.60	1,680	5.80	3,000	9.00	5,170
2.40	1,010	3.70	1,740	6.00	3,120	9.50	5,570
2.50	1,065	3.80	1,800	6.20	3,250	10.00	6,060
2.60	1,120	3.90	1,860	6.40	3,380	11.00	7,380
2.70	1,175	4.00	1,920	6.60	3,510	12.00	9,020
2.80	1,230	4.20	2,040	6.80	3,640	13.00	11,140
2.90	1,285	4.40	2,160	7.00	3,770	14.00	13,900
3.00	1,340	4.60	2,280	7.20	3,900		
3.10	1,395	4.80	2,400	7.40	4,030		
3.20	1,450	5.00	2,520	7.60	4,160		

JANUARY 1 TO DECEMBER 31, 1904.[c]

—0.30	250	0.70	480	1.70	810	3.40	1,660
— .20	270	.80	510	1.80	850	3.60	1,770
— .10	290	.90	540	1.90	895	3.80	1,890
.00	310	1.00	570	2.00	940	4.00	2,010
.10	330	1.10	600	2.20	1,030	4.20	2,130
.20	350	1.20	630	2.40	1,130	4.40	2,250
.30	375	1.30	665	2.60	1,230	4.60	2,370
.40	400	1.40	700	2.80	1,330	4.80	2,490
.50	425	1.50	735	3.00	1,440	5.00	2,610
.60	450	1.60	770	3.20	1,550		

JANUARY 1 TO DECEMBER 31, 1905.[c]

—0.60	270	0.70	640	2.00	1,075	3.60	1,800
— .50	295	.80	670	2.10	1,110	3.80	1,910
— .40	320	.90	700	2.20	1,150	4.00	2,020
— .30	345	1.00	730	2.30	1,190	4.20	2,130
— .20	370	1.10	760	2.40	1,230	4.40	2,250
— .10	400	1.20	795	2.50	1,270	4.60	2,370
.00	430	1.30	830	2.60	1,315	4.80	2,490
.10	460	1.40	865	2.70	1,360	5.00	2,610
.20	490	1.50	900	2.80	1,405		
.30	520	1.60	935	2.90	1,450		
.40	550	1.70	970	3.00	1,500		
.50	580	1.80	1,005	3.20	1,600		
.60	610	1.90	1,040	3.40	1,700		

[a] Above gage height 10.0 feet this table is the same as the 1900 table.
[b] Above gage height 14.0 feet this table is the same as the 1900 table.
[c] For gage heights above 5.0 feet the discharge has been estimated from 1903 measurements.

Estimated monthly discharge of Ocmulgee River at Macon.

[Drainage area, 2,425 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1893.					
31	4,240	1,887	2,881	1.19	0.48
	18,550	1,328	5,667	2.34	2.44
24 to 31	13,385	1,672	4,438	1.83	1.90
	7,250	1,285	1,938	0.80	0.89
	4,830	855	1,844	0.76	0.87
	8,205	1,200	2,352	0.97	1.08
	3,330	1,113	1,411	0.58	0.67
	15,100	1,242	2,336	0.96	1.10
	10,130	1,371	2,787	1.15	1.28
	5,750	1,328	1,905	0.79	0.91
	2,050	1,414	1,552	0.64	0.71
	2,285	1,414	1,794	0.74	0.85
1894.					
	4,430	1,457	2,246	0.93	1.07
	15,925	1,629	4,488	1.85	1.92
	9,285	2,050	3,415	1.41	1.63
	4,155	1,629	2,409	0.99	1.10
	2,050	1,285	1,464	0.60	0.69
	2,050	1,113	1,359	0.56	0.62
	5,635	1,285	2,391	0.98	1.13
	17,350	2,050	3,854	1.59	1.83
	10,795	1,200	2,723	1.12	1.25
	20,075	1,113	2,841	1.17	1.35
	4,600	1,200	1,980	0.82	0.91
	14,550	1,156	2,827	1.17	1.35
r	20,075	1,113	2,666	1.10	14.85
1895.					
	19,750	1,629	4,608	1.94	2.24
	3,750	2,100	2,610	1.08	1.13
	30,715	2,050	8,187	3.38	3.90
	12,975	2,470	5,040	2.08	2.32
	12,975	2,320	3,244	1.34	1.54
	2,800	2,006	2,322	0.96	1.07
	15,100	2,006	4,360	1.80	2.08
	14,000	1,963	4,529	1.87	2.16
	3,090	2,050	2,502	1.03	1.15
	1,629	842	1,036	0.43	0.49
	1,174	971	1,016	0.42	0.47
	2,776	941	1,284	0.53	0.61
r	30,715	842	3,402	1.40	19.16
1896.					
	13,600	1,178	3,353	1.38	1.59
	14,270	1,801	3,889	1.60	1.73
	4,800	1,586	2,884	1.19	1.37
	2,860	1,049	1,449	0.60	0.67
	1,942	727	1,001	0.41	0.47
	1,586	405	888	0.37	0.41
	36,200	340	7,436	3.07	3.54
	2,075	727	1,150	0.47	0.54
	813	380	608	0.25	0.28
	727	380	487	0.20	0.23
	17,950	706	3,227	1.33	1.48
	13,200	1,070	3,261	1.35	1.56
	36,200	340	2,469	1.02	13.87
1897.					
	4,400	882	1,369	0.56	0.64
	17,450	1,584	4,275	1.76	1.83
	28,700	1,604	8,877	3.66	4.22
	21,575	1,604	5,463	2.25	2.51
	2,221	1,269	1,692	0.70	0.81
	2,206	1,094	1,732	0.71	0.79
	8,250	781	1,913	0.79	0.91
	6,120	772	1,759	0.73	0.84
	1,416	481	715	0.29	0.32
	1,048	442	622	0.26	0.30
	2,132	481	780	0.32	0.36
	1,361	864	1,059	0.44	0.51
	28,700	442	2,521	1.04	14.04

Estimated monthly discharge of Ocmulgee River at Macon—Continued.

Month.	Discharge in second-feet.			Run-off	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1898.					
January	3,472	860	1,300	0.54	
February	1,195	820	964	0.40	
March	2,675	840	1,263	0.52	
April	12,120	940	2,619	1.08	
May	1,555	600	909	0.38	
June	1,740	388	653	0.27	
July	5,880	405	1,645	0.68	
August	15,000	940	4,630	1.91	
September	31,640	1,040	6,008	2.48	
October	28,760	1,020	5,734	2.36	
November	18,520	1,555	3,698	1.52	
December	16,920	2,042	3,567	1.47	
The year	31,640	388	2,749	1.13	
1899.					
January	19,840	2,380	5,570	2.30	
February	21,920	3,820	8,140	3.36	
March	18,292	3,460	5,495	2.27	
April	11,060	2,770	4,481	1.85	
May	5,090	1,390	2,112	0.87	
June	2,800	810	1,331	0.55	
July	3,220	650	1,196	0.49	
August	2,140	620	1,071	0.44	
September	1,720	580	880	0.36	
October	6,820	600	1,339	0.55	
November	3,340	620	987	0.41	
December	4,000	850	1,581	0.65	
The year	21,920	580	2,849	1.17	
1900.					
January	2,920	940	1,530	0.63	
February	46,240	1,090	9,700	4.00	
March	7,900	3,280	4,644	1.92	
April	30,700	2,620	7,005	2.89	
May	5,490	1,900	2,871	1.18	
June	39,940	1,900	8,216	3.39	
July	11,950	2,140	3,615	1.49	
August	3,820	1,480	1,995	0.82	
September	11,950	1,195	2,560	1.06	
October	5,250	1,195	1,876	0.77	
November	9,940	1,360	2,307	0.95	
December	10,840	1,660	4,079	1.68	
The year	46,240	940	4,200	1.73	
1901.					
January	13,010	2,244	4,908	2.02	
February	21,880	2,185	5,165	2.13	
March	22,720	1,693	4,586	1.89	
April	34,060	2,244	6,556	2.70	
May	13,590	1,546	2,806	1.16	
June	6,704	1,693	3,323	1.37	
July	19,780	1,314	2,521	1.04	
August	16,420	1,184	4,686	1.93	
September	29,440	1,227	3,913	1.61	
October	3,081	978	1,412	.58	
November	1,314	978	1,104	.46	
December	30,280	1,059	4,324	1.78	
The year	34,060	978	3,775	1.55	
1902.					
January	21,040	800	2,242	.92	
February	38,680	2,060	8,444	3.48	
March	50,860	4,280	12,700	5.24	
April	10,840	2,780	4,738	1.95	
May	3,290	1,540	2,292	.95	
June	3,120	995	1,631	.67	
July	2,300	800	1,169	.48	
August	6,260	865	1,624	.67	
September	3,680	865	1,377	.57	
October	2,620	800	1,430	.59	
November	5,540	800	1,422	.59	
December	11,950	1,125	2,961	1.22	
The year	50,860	800	3,502	1.44	

Estimated monthly discharge of Ocmulgee River at Macon—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
	2,760	1,800	2,191	0.90	1.04
	42,040	1,920	11,845	4.89	5.09
	31,960	3,380	9,561	3.94	4.54
	15,160	2,760	5,003	2.06	2.30
	7,380	2,040	2,991	1.23	1.42
	28,180	1,920	4,962	2.05	2.29
	7,380	1,450	2,558	1.05	1.21
	7,660	1,175	2,460	1.01	1.16
	16,840	810	2,380	.98	1.09
	2,460	960	1,110	.46	.53
	1,980	910	1,235	.51	.57
	1,740	960	1,272	.52	.60
ear	42,040	810	3,964	1.63	21.84
1904.					
	9,480	985	2,064	.851	.981
	6,540	1,495	3,149	1.30	1.40
	4,100	1,440	2,214	.913	1.05
	3,050	1,330	1,535	.633	.706
	1,830	665	1,120	.462	.533
	2,490	510	1,029	.424	.473
	2,370	480	772	.318	.367
	12,600	810	2,967	1.22	1.41
	2,430	330	671	.277	.309
	400	250	300	.124	.143
	985	290	602	.248	.277
	3,505	570	1,295	.534	.616
ear	12,600	250	1,476	.609	8.26
1905.					
	5,170	970	1,599	.659	.760
	23,980	1,040	5,307	2.19	2.28
	2,940	1,230	1,816	.749	.864
	3,315	1,075	1,484	.612	.683
	2,460	935	1,539	.635	.732
	2,400	640	1,072	.442	.493
	4,560	700	1,878	.774	.892
	6,830	400	1,466	.605	.698
	1,230	270	533	.220	.246
	1,450	466	696	.287	.331
	2,130	526	810	.334	.373
	25,240	670	5,580	2.30	2.65
ear	25,240	270	1,982	.817	11.00

ights from October 3 to 5 are considered too low to represent the true mean. The mini- arge for the month has been assumed to apply for those days.

YELLOW RIVER NEAR STONE MOUNTAIN.

station was established in 1905 for the purpose of making a miscellaneous measurements. It is located at the single-span known as Sextons Bridge, about 6 miles east from Stone in and 2½ miles above the old Annistown factory site, where a large amount of fall.

ection is good for measurements, but the bed is sandy and . Discharge measurements are made from the bridge. Gage are determined directly from the bench mark, which is the he downstream end of the floor beam at the middle of the levation, 21.00 feet above the datum of the assumed gage.

Discharge measurements of Yellow River near Stone Mountain.

Date.	Gage height.	I ch
1905.	*Feet.*	*Se*
January 28	1.96	
November 23	1.78	

YELLOW RIVER AT ALMON.

A temporary station was maintained from September 12 to Dec ber 31, 1897, at a low bridge about 200 yards below the Georgia R road crossing. No records were kept during 1898. On May 9, 18 the station was reestablished at a wagon bridge about three-fou of a mile north of the town of Almon and the same distance up river from the Georgia Railroad crossing. The station was disc tinued December 31, 1901.

The gage is fastened to the side of the upstream post of a bri bent near the left bank. The bench mark is a railroad spike dri into a sycamore tree on the left bank of the river about 100 feet ab the bridge; elevation, 7.00 feet above gage datum.

Discharge measurements of Yellow River at Almon.

Date.	Gage height.	Dis-charge.	Date.	Gage height.	D ch
1896.	*Feet.*	*Sec.-ft.*	1899.	*Feet.*	*Se*
September 19	0.75	62	August 7	1.40	
1897.			October 19	1.70	
March 27	3.90	876	1900.		
June 21	2.50	287	April 19	9.00	
September 7	1.53	123	November 30	2.40	
December 8	2.10	227	December 22	4.50	
1899.			1901.		
May 3	2.97	481	January 29	3.40	
May 9	3.16	561	April 3	13.80	
May 16	2.30	364	June 14	3.80	
June 6	1.80	235	August 8	2.58	
June 27	2.42	427	October 26	2.33	

Daily gage height, in feet, of Yellow River at Almon.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	D
1897.					1897.				
1		1.2	1.6	2.2	17	1.25	1.5	1.68	
2		1.1	1.65	2.8	18	1.3	1.6	1.69	
3		1.15	1.98	2.7	19	1.3	1.7	1.65	
4		1.2	1.9	2.2	20	1.22	1.8	1.64	
5		1.1	1.88	2.8	21	1.2	1.7	1.68	
6		1.15	1.7	2.9	22	1.2	1.68	1.67	
7		1.1	1.5	2.1	23	1.28	1.66	1.66	
8		1.1	1.6	2.08	24	1.35	1.6	1.7	
9		1.15	1.75	2.06	25	1.25	1.58	1.68	
10		1.2	1.7	2.0	26	1.3	1.5	1.7	
11		1.35	1.68	1.98	27	1.35	1.4	1.7	
12	1.4	1.9	1.66	1.98	28	1.3	1.4	1.76	
13	1.3	1.98	1.64	1.95	29	1.28	1.45	1.8	
14	1.42	1.9	1.64	1.89	30	1.24	1.5	2.0	
15	1.4	1.8	1.64	1.86	31		1.5		
16	1.3	1.52	1.64	1.90					

Daily gage height, in feet, of Yellow River at Almon—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
						2.4	1.6	1.9	2.1	1.2	1.6	2.0
						2.1	1.5	1.8	2.0	1.2	1.6	2.7
						2.0	1.4	1.7	1.8	1.2	1.5	2.5
						1.9	1.3	1.6	1.6	1.2	1.5	2.3
						1.8	1.4	1.6	1.5	1.7	1.5	2.0
						1.8	1.5	1.4	1.5	2.0	1.5	1.9
						1.7	1.8	1.4	1.5	2.5	1.5	1.9
						1.7	1.6	1.4	1.5	4.0	1.5	1.9
					3.2	1.7	1.8	1.3	1.4	2.8	1.5	1.9
					2.8	1.7	1.6	1.3	1.4	2.2	1.5	1.9
					2.8	1.7	1.4	1.3	2.5	1.8	1.5	1.9
					2.7	2.0	1.4	1.3	2.0	1.8	1.5	4.0
					2.7	2.5	1.3	1.2	1.7	1.8	1.5	3.0
					2.5	2.1	1.3	1.2	1.5	1.8	1.5	2.5
					2.5	1.9	1.2	1.2	1.5	1.7	1.5	2.3
					2.5	1.8	1.2	1.1	1.4	1.7	1.6	2.0
					2.3	1.8	1.2	1.1	1.4	1.7	1.5	2.0
					2.1	1.8	1.8	1.0	1.4	1.7	1.5	2.0
					2.3	1.7	1.4	1.0	1.3	1.7	1.5	2.0
					2.1	1.6	1.4	1.0	1.3	2.0	1.5	2.0
					2.0	1.5	1.6	1.0	1.3	1.9	1.5	2.0
					2.3	1.5	1.8	1.0	1.3	1.7	1.5	2.0
					2.8	1.5	2.0	1.0	1.3	1.5	2.2	2.0
					2.5	1.4	1.4	1.0	1.2	1.5	2.2	5.5
					2.2	1.4	1.6	1.0	1.2	1.5	1.9	4.6
					2.0	3.2	2.4	3.6	1.2	1.5	4.5	3.4
					2.0	2.6	5.8	3.0	1.2	1.5	4.0	2.5
					2.0	2.0	5.0	2.8	1.2	1.5	3.2	2.5
					1.9	2.0	3.7	2.7	1.2	1.6	2.5	2.5
					1.8	1.8	2.8	2.5	1.2	1.7	2.0	2.5
					3.3	.....	2.0	2.3	.....	1.7	.....	2.3
1900.												
	2.1	2.0	4.5	3.1	3.7	2.4	4.0	3.4	3.0	2.0	2.0	2.4
	1.9	2.0	4.5	3.0	3.8	2.4	5.0	2.7	3.0	2.0	2.0	2.3
	1.9	2.0	3.5	3.0	7.2	2.4	5.0	2.5	2.5	2.0	2.0	2.3
	1.9	2.0	3.4	3.0	6.9	2.4	4.7	2.3	2.3	2.5	4.3	7.5
	2.0	2.5	3.2	3.0	4.0	3.4	4.0	2.3	2.1	2.5	4.0	7.0
	2.0	2.7	3.0	3.0	3.6	4.0	3.5	2.2	2.1	2.8	3.0	5.0
	2.0	2.5	3.0	2.9	3.4	3.4	3.0	2.1	2.0	3.5	2.5	3.5
	2.0	2.5	4.7	2.9	3.2	6.7	3.0	2.0	2.0	4.0	2.0	3.0
	2.0	3.5	10.0	2.9	3.1	4.4	3.0	2.0	2.0	3.0	2.0	2.9
	2.3	5.7	6.0	2.9	3.0	3.3	3.0	2.0	2.0	2.7	2.0	2.8
	2.9	5.9	4.0	3.9	3.0	3.1	3.0	1.9	2.0	2.4	2.0	2.8
	4.4	15.0	3.8	4.7	3.0	2.9	3.0	1.9	2.0	2.4	2.0	2.9
	3.5	20.0	3.6	4.0	2.9	2.8	3.0	1.9	2.0	2.4	2.0	2.7
	3.0	15.0	3.4	3.4	2.8	3.2	3.0	1.9	3.0	2.3	2.0	4.0
	2.5	7.0	3.3	3.0	2.8	3.0	3.0	2.5	8.0	2.3	2.0	3.5
	2.5	5.0	3.8	2.0	2.8	4.0	2.8	2.3	7.0	2.2	2.0	3.2
	2.4	4.9	3.4	3.0	2.8	6.0	2.7	2.2	4.0	2.1	2.0	3.0
	3.4	4.7	3.0	8.0	2.7	5.0	2.6	2.0	3.0	2.0	2.0	2.8
	4.0	3.6	3.4	9.0	3.5	4.0	2.5	2.0	2.5	2.0	2.0	2.8
	4.3	4.7	5.0	6.8	2.8	3.5	2.0	2.0	2.0	2.0	2.0	5.0
	3.6	3.9	4.3	12.0	2.8	3.2	2.0	2.0	2.0	2.0	2.0	6.5
	3.0	3.8	3.7	10.0	2.6	3.0	2.0	2.5	2.0	2.0	2.0	4.5
	2.8	3.7	3.4	6.0	2.6	7.5	2.0	2.5	2.0	3.0	2.0	3.5
	2.6	3.7	3.7	7.2	4.0	11.0	2.0	2.4	2.0	3.0	2.0	3.5
	2.5	3.7	5.5	12.0	3.0	11.0	2.5	2.3	2.0	2.5	2.0	3.5
	2.4	3.8	8.0	6.8	2.8	12.0	2.0	2.0	2.0	2.3	4.5	3.0
	2.3	3.8	6.0	6.0	2.6	9.0	3.0	2.0	2.0	2.0	3.5	3.0
	2.2	3.8	4.4	5.8	2.4	9.5	3.5	2.0	2.0	2.0	2.5	2.9
	2.1	.....	4.0	5.4	2.4	6.3	3.5	2.0	2.0	2.0	2.4	2.9
	2.0	.....	3.5	4.3	2.4	5.0	5.0	2.0	2.0	2.0	2.4	4.0
	2.0	.....	3.2	.....	2.4	.....	4.0	5.0	.....	2.0	.....	7.5
1901.												
	6.0	3.4	3.2	6.0	3.2	5.0	3.2	2.4	5.5	3.0	2.2	2.4
	5.5	3.4	3.2	11.0	3.1	4.1	3.0	2.3	4.2	4.5	2.2	2.4
	6.0	10.0	3.1	13.9	3.0	3.5	2.9	2.2	3.1	4.3	2.4	3.0
	5.0	15.0	3.1	8.8	3.0	3.4	2.8	2.2	3.4	4.0	2.4	2.9
	4.3	12.0	3.1	5.5	3.0	3.3	2.7	2.1	3.4	3.2	2.4	2.8

Daily gage height, in feet, of Yellow River at Almon—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1901.											
6	4.0	5.5	3.0	5.0	3.0	3.2	2.6	2.8	3.1	3.0	2.4
7	3.8	5.5	3.0	4.5	3.0	4.4	2.5	3.0	3.0	3.0	2.4
8	3.7	5.8	3.0	4.0	2.9	3.5	2.4	2.8	2.9	3.0	2.4
9	3.5	6.3	3.0	3.9	2.9	3.4	2.3	2.5	2.9	3.0	2.4
10	3.4	5.4	3.0	3.8	2.8	3.3	2.2	2.4	2.8	3.0	2.4
11	5.0	4.6	4.5	3.7	2.8	3.2	2.4	2.8	2.8	3.0	2.4
12	10.0	4.4	4.0	3.7	2.8	3.0	2.3	4.2	2.8	3.0	2.4
13	10.0	4.0	3.5	4.0	2.7	3.4	2.2	3.4	2.8	2.8	2.4
14	5.5	3.9	3.0	9.5	2.7	3.6	2.2	2.8	2.8	2.8	2.4
15	4.5	3.7	2.9	8.4	2.7	6.7	2.8	3.8	2.8	2.7	2.4
16	4.2	3.5	2.8	5.2	2.6	7.0	3.0	7.0	2.8	2.7	2.4
17	4.0	3.4	2.8	5.0	2.6	4.8	3.8	7.5	3.5	2.7	3.0
18	4.0	3.4	2.8	4.0	2.8	7.0	3.4	4.8	9.0	2.7	3.0
19	3.8	3.4	2.8	5.1	2.8	6.1	10.0	3.5	10.0	2.7	3.0
20	3.8	3.4	2.8	5.4	2.8	4.1	7.0	6.0	4.8	2.7	3.0
21	3.5	3.3	2.8	4.5	5.0	3.2	3.4	3.9	3.0	2.7	3.0
22	3.5	3.2	2.8	4.0	7.5	3.2	3.2	6.0	3.6	2.6	3.0
23	3.4	3.2	2.8	3.9	6.1	3.1	2.9	10.0	3.6	2.6	3.0
24	3.8	3.2	5.4	3.8	4.2	3.0	2.8	8.0	3.4	2.6	3.0
25	4.0	3.4	6.0	3.7	3.6	3.0	2.7	4.7	3.2	2.5	2.8
26	3.5	3.2	7.0	3.6	3.4	4.0	2.6	3.8	3.2	2.5	2.7
27	3.4	3.2	10.0	3.5	3.3	4.2	2.4	5.0	3.0	2.5	2.6
28	3.4	3.2	7.0	3.5	3.2	3.3	2.3	9.0	3.0	2.5	2.5
29	3.4	.....	5.0	3.4	3.0	3.1	2.2	10.0	3.0	2.5	2.4
30	4.0	.....	4.0	3.3	2.9	3.1	2.7	4.8	3.0	2.4	2.4
31	3.5	.....	3.0	.....	5.2	.....	2.5	4.0	.....	2.3	.....

Rating tables for Yellow River at Almon.[a]

SEPTEMBER 12 TO DECEMBER 31, 1897.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	85	1.60	130	2.10	194	2.60	326
1.20	93	1.70	140	2.20	211	2.70	368
1.30	101	1.80	152	2.30	231	2.80	408
1.40	110	1.90	165	2.40	256	2.90	450
1.50	120	2.00	179	2.50	280		

MAY 9 TO DECEMBER 31, 1899.

1.00	120	2.20	345	3.40	615	4.60	885
1.10	133	2.30	367	3.50	637	4.70	907
1.20	147	2.40	390	3.60	660	4.80	930
1.30	160	2.50	412	3.70	682	4.90	952
1.40	175	2.60	435	3.80	705	5.00	975
1.50	193	2.70	457	3.90	727	5.20	1,020
1.60	212	2.80	480	4.00	750	5.40	1,065
1.70	233	2.90	502	4.10	772	5.60	1,110
1.80	255	3.00	525	4.20	795	5.80	1,155
1.90	277	3.10	547	4.30	817		
2.00	300	3.20	570	4.40	840		
2.10	322	3.30	592	4.50	862		

[a] Above gage height 3.8 feet the rating curve is a tangent, the difference being 39 per tenth.

Rating tables for Yellow River at Almon—Continued.

JANUARY 1 TO DECEMBER 31, 1900.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	275	3.60	660	5.60	1,480	9.00	3,300
2.00	290	3.70	690	5.80	1,585	9.50	3,568
2.10	310	3.80	720	6.00	1,690	10.00	3,837
2.20	330	3.90	750	6.20	1,797	10.50	4,106
2.30	350	4.00	780	6.40	1,904	11.00	4,375
2.40	370	4.10	815	6.60	2,012	11.50	4,643
2.50	390	4.20	850	6.80	2,119	12.00	4,912
2.60	410	4.30	885	7.00	2,227	12.50	5,181
2.70	430	4.40	920	7.20	2,334	13.00	5,450
2.80	455	4.50	955	7.40	2,441	13.50	5,718
2.90	480	4.60	990	7.60	2,549	14.00	5,987
3.00	505	4.70	1,035	7.80	2,656	15.00	6,525
3.10	530	4.80	1,080	8.00	2,763	16.00	7,062
3.20	555	4.90	1,125	8.20	2,870	17.00	7,600
3.30	580	5.00	1,175	8.40	2,977	18.00	8,137
3.40	605	5.20	1,275	8.60	3,085	19.00	8,675
3.50	630	5.40	1,375	8.80	3,192	20.00	9,212

JANUARY 1 TO DECEMBER 31, 1901.

2.10	235	3.80	652	6.00	1,510	9.40	2,836
2.20	250	3.90	691	6.20	1,588	9.60	2,914
2.30	266	4.00	730	6.40	1,666	9.80	2,992
2.40	283	4.10	769	6.60	1,744	10.00	3,070
2.50	301	4.20	808	6.80	1,822	11.00	3,460
2.60	320	4.30	847	7.00	1,900	12.00	3,850
2.70	340	4.40	886	7.20	1,978	13.00	4,240
2.80	361	4.50	925	7.40	2,056	14.00	4,630
2.90	383	4.60	964	7.60	2,134	15.00	5,020
3.00	406	4.70	1,003	7.80	2,212	16.00	5,410
3.10	430	4.80	1,042	8.00	2,290	17.00	5,800
3.20	455	4.90	1,081	8.20	2,368	18.00	6,190
3.30	482	5.00	1,120	8.40	2,446	19.00	6,580
3.40	511	5.20	1,198	8.60	2,524	20.00	6,970
3.50	543	5.40	1,276	8.80	2,602		
3.60	577	5.60	1,354	9.00	2,680		
3.70	614	5.80	1,432	9.20	2,758		

Estimated monthly discharge of Yellow River at Almon.

[Drainage area, 379 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1897.					
September 12-30	112	93	101	0.27	0.15
October	174	85	119	.31	.3
November	179	120	141	.37	.4
December	450	160	215	.57	.6
1899.					
May 9-31	570	255	391	1.03	.8
June	570	175	276	.73	.8
July	1,155	147	284	.75	.8
August	660	120	223	.59	.6
September	412	147	197	.52	.5
October	750	147	256	.68	.7
November	862	193	272	.72	.8
December	1,087	277	405	1.07	1.2
1900.					
January	920	275	427	1.13	1.3
February	9,225	290	1,493	3.94	4.1
March	3,837	505	963	2.54	2.9
April	4,912	290	1,432	3.78	4.2
May	2,333	370	622	1.64	1.9
June	4,912	370	1,390	3.67	4.1
July	1,175	290	570	1.50	1.7
August	1,175	275	358	.94	1.0
September	2,763	290	492	1.30	1.4
October	780	290	373	.98	1.1
November	955	290	379	1.00	1.1
December	2,492	350	806	2.13	2.4
The year	9,225	275	775	2.05	27.8
1901.					
January	3,070	511	934	2.46	2.8
February	5,020	455	1,076	2.84	2.9
March	3,070	361	710	1.87	2.1
April	4,591	482	1,221	3.22	3.5
May	2,095	320	551	1.45	1.6
June	1,900	406	741	1.96	2.1
July	3,070	250	488	1.29	1.4
August	3,070	235	988	2.61	3.0
September	3,070	361	655	1.73	1.9
October	925	266	397	1.05	1.2
November	406	260	320	.84	.9
December	6,970	283	880	2.32	2.6
The year	6,970	235	947	1.97	26.6

ALCOVY RIVER NEAR COVINGTON.

This station was established on April 30, 1901, about 3 miles east of Covington, at a low wooden bridge which is often under water. It was discontinued on December 31, 1904.

The banks are low and liable to overflow. The ground on the right bank is low and swampy for several hundred yards and is flooded by a moderate rise. The bed of the stream is sandy and shifting, and the water is sluggish at low stages. Discharge measurements were made from the upstream side of a low, two-span, wooden bridge about 100 feet long. The initial point for soundings is the end of the bridge floor on the left bank, upstream side. The gage is a vertical rod 10 feet long, spiked to a birch tree on the left bank of the river 2 feet from the upstream side of the bridge. The observer was Stephen Belcher,

mer living near, who was paid by the Georgia Geological Survey. ch mark No. 2 is a copper plug set in the solid rock on the north of the side ditch on the upstream side of the road, 100 feet from end of the bridge, on the left bank of the river; elevation, 7.82 above the zero of the gage.

Discharge measurements of Alcovy River near Covington.

Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*
10	3.00	307
4	3.12	353
t 8	3.64	376
er 26	2.00	162
1902.		
ary 27	4.87	661
4	1.70	156
3	1.32	127
nber 12	1.20	128
1903.		
11	4.41	575
3	3.48	385
4	1.92	174
1903.		
August 27	1.60	127
October 8	1.50	120
November 14	1.90	157
December 19	1.85	155
1904.		
February 20	3.67	415
April 13	2.11	202
June 16	.63	68
July 12	1.00	94
September 22	.45	53
September 22[a]	.45	42
September 22[b]	.45	42
December 6	3.35	328
December 6	3.38	358

[a] 200 feet below bridge.

[b] 300 feet above bridge.

Daily gage height, in feet, of Alcovy River near Covington.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
					2.9	4.2	4.0	1.6	5.0	3.0	2.0	2.1
					2.8	4.3	3.4	1.5	4.5	4.3	2.0	2.0
					2.8	4.0	2.8	1.4	3.7	4.3	2.0	2.8
					2.7	3.3	2.6	1.6	3.0	4.2	2.0	3.2
					2.7	3.0	2.4	1.6	2.8	3.2	2.3	3.0
					2.7	2.7	2.2	4.3	2.5	2.9	2.1	2.7
					2.8	4.5	2.0	5.1	2.4	2.5	2.1	2.5
					2.6	4.0	1.9	4.0	2.2	2.3	2.1	2.5
					2.5	3.2	1.9	2.5	2.0	2.3	2.0	2.4
					2.4	2.6	1.8	2.1	2.0	2.3	2.1	2.9
					2.4	2.4	2.0	5.2	2.0	2.3	2.1	3.0
					2.3	2.3	2.5	5.0	2.0	2.3	2.1	2.7
					2.3	2.5	3.1	4.0	1.9	2.5	2.1	2.5
					2.4	3.1	3.9	3.5	2.0	2.4	2.1	2.5
					2.3	3.3	4.6	4.8	2.1	2.4	2.0	5.2
					2.2	3.8	4.3	6.1	2.0	2.3	2.0	5.3
					2.1	4.3	4.0	5.9	5.0	2.1	2.0	4.5
					2.0	4.8	3.8	5.5	6.3	2.0	2.1	4.2
					2.0	5.7	3.3	5.3	5.9	2.0	2.1	3.0
					2.5	5.3	4.0	4.6	6.0	2.0	2.5	2.8
					3.4	5.0	4.8	5.6	5.3	1.9	2.8	2.4
					4.5	3.6	5.3	5.6	3.9	1.9	2.6	2.8
					4.2	2.9	5.8	6.8	3.2	1.9	2.4	2.8
					3.7	2.6	5.0	6.2	2.9	2.0	2.4	3.0
					3.2	2.4	4.2	5.0	2.8	2.0	2.3	3.2
					2.9	2.8	3.7	4.5	2.6	2.0	2.3	3.3
					2.8	4.5	3.2	4.0	2.5	2.0	2.2	3.1
					2.7	5.1	2.7	4.7	2.4	2.0	2.1	3.8
					2.5	4.9	2.5	6.2	2.4	2.0	2.1	5.4
				3.0	2.4	3.6	2.0	6.0	2.5	2.0	2.1	6.9
					3.3		2.4	4.9		2.0		7.4
1902.												
	6.5	5.2	9.5	5.6	3.0	1.9	1.0	1.8	1.4	2.7	1.6	3.5
	5.4	7.3	7.2	5.0	3.5	1.4	1.0	1.4	1.3	2.5	1.7	5.0
	4.8	8.8	6.2	4.8	3.2	2.2	1.0	4.2	1.2	2.0	1.6	5.3
	4.3	7.0	5.8	4.5	3.0	2.0	2.2	3.7	1.0	1.7	1.9	5.1
	4.0	6.7	5.3	4.3	2.9	1.9	1.7	5.0	1.0	2.0	2.2	4.9

Daily gage height, in feet, of Alcovy River near Covington—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	De.
1902.												
6	3.7	6.3	5.0	4.2	2.8	1.7	1.7	3.8	1.0	1.9	2.1	4.
7	3.5	4.9	4.8	4.5	2.7	1.7	1.5	2.5	1.2	1.8	2.0	2.
8	3.4	4.4	4.6	4.9	2.6	2.5	1.3	2.4	1.1	1.7	2.0	2.
9	3.3	4.3	4.5	4.7	2.7	3.8	1.2	1.9	1.0	1.6	1.6	1.
10	3.2	4.0	4.4	4.5	2.6	2.7	1.1	1.5	1.0	1.6	1.6	2.
11	3.1	3.8	4.3	4.0	2.6	2.2	1.0	1.4	1.0	1.6	1.5	2.
12	3.0	3.7	4.2	3.8	2.6	2.0	2.5	1.3	1.8	2.2	1.5	2.
13	2.9	3.6	4.0	3.8	2.5	1.9	2.0	1.0	2.9	2.5	1.5	2.
14	2.8	3.6	4.4	3.7	2.5	1.8	1.9	1.0	3.3	2.6	1.4	2.
15	2.7	3.6	4.8	3.7	2.5	2.2	1.8	2.0	2.9	2.1	1.4	2.
16	2.8	3.8	5.8	3.6	2.6	2.7	1.7	1.9	2.4	1.9	1.6	2.
17	2.8	3.8	6.8	3.6	2.5	2.5	1.6	1.2	2.0	1.7	1.6	1.
18	2.7	3.8	6.7	4.3	2.8	2.3	1.4	1.1	1.7	1.5	2.7	1.
19	2.8	3.7	6.0	4.2	2.7	2.2	1.4	1.3	2.2	1.7	3.2	2.
20	2.8	3.7	5.7	4.0	2.6	2.1	1.1	1.2	2.8	1.8	2.9	2.
21	3.0	3.8	5.1	3.9	2.4	1.9	1.1	1.1	2.9	1.6	2.2	1.
22	3.4	3.8	4.8	3.8	2.6	1.9	1.1	1.0	2.4	1.6	2.0	2.
23	3.5	3.8	4.5	3.7	2.4	1.8	1.1	1.0	2.1	1.6	1.7	2.
24	3.0	4.2	4.5	3.7	2.4	1.8	1.1	1.0	1.6	1.6	1.7	2.
25	3.0	4.3	4.5	3.5	2.3	1.8	1.0	1.0	3.0	1.6	3.3	2.
26	3.0	4.4	4.3	3.4	2.2	1.8	1.0	1.0	3.0	1.7	4.1	2.
27	3.0	5.0	3.9	3.0	2.0	1.8	1.0	1.0	3.4	2.1	3.3	2.
28	3.0	12.8	4.3	3.0	2.0	1.8	2.3	1.2	2.8	2.0	3.0	2.
29	3.2	.....	5.5	3.0	2.0	1.2	3.5	1.9	2.6	1.9	2.4	2.
30	3.6	.....	7.4	3.0	2.0	1.2	3.7	2.4	2.8	1.8	2.4	2.
31	4.0	.....	6.9	.....	2.0	.....	2.8	1.5	.....	1.7	.....	2.
1903.												
1	3.2	2.5	4.9	6.3	3.0	7.0	2.8	1.9	1.2	1.5	1.7	1.
2	3.0	2.5	5.5	5.7	3.0	6.7	2.6	2.5	1.2	1.4	1.7	1.
3	2.9	2.7	5.2	5.0	3.0	5.7	2.7	4.5	1.2	1.4	1.8	1.
4	3.0	3.0	4.7	4.8	5.7	5.2	2.8	3.8	1.2	1.6	2.3	1.
5	2.9	3.6	4.5	4.7	5.0	5.4	2.7	3.0	1.4	1.6	2.7	1.
6	2.8	4.0	4.2	4.5	4.5	6.1	2.6	2.7	1.3	1.5	3.0	2.
7	2.7	4.4	4.2	4.3	4.0	6.0	4.5	2.6	1.2	1.5	2.5	2.
8	2.6	8.0	4.1	4.8	3.4	5.5	5.5	2.4	1.2	1.5	2.0	2.
9	2.5	7.5	4.0	6.1	3.5	4.5	4.4	1.8	1.2	1.5	1.9	2.
10	2.3	7.0	4.5	5.9	3.3	4.0	3.7	1.7	1.2	1.5	1.9	2.
11	2.8	6.5	4.4	5.6	3.1	3.8	4.8	1.6	1.1	1.4	1.9	2.
12	3.0	6.5	4.3	4.5	3.0	3.5	4.0	1.6	1.1	1.4	1.9	2.
13	3.3	6.6	4.7	4.4	2.9	3.3	6.5	1.6	1.0	1.4	1.9	2.
14	2.9	6.2	5.1	4.7	3.3	3.0	6.3	2.2	1.2	1.4	1.9	2.
15	2.8	5.3	4.7	4.5	4.0	2.9	5.1	3.0	3.3	1.4	1.9	2.
16	2.7	4.9	4.6	4.3	4.2	2.8	4.2	4.0	4.4	1.4	1.9	2.
17	2.6	6.5	4.5	4.0	4.0	2.7	3.2	4.5	4.7	1.4	2.5	2.
18	2.5	6.7	4.0	3.8	3.5	2.6	2.9	3.5	4.0	2.0	2.2	2.
19	2.4	6.6	3.8	3.8	3.1	2.4	2.7	2.4	3.7	1.9	2.2	1.
20	2.3	5.4	3.7	3.7	2.9	2.4	2.5	2.0	2.4	1.8	2.0	2.
21	2.2	4.8	3.8	3.6	2.8	3.0	2.3	2.4	2.2	1.7	2.0	2.
22	2.2	4.6	5.5	3.4	2.7	2.8	2.1	3.6	2.0	1.6	2.0	2.
23	2.2	4.3	7.5	3.1	2.6	2.6	2.0	3.0	1.9	1.6	2.0	2.
24	2.4	4.0	8.6	2.0	2.5	2.4	1.9	2.5	1.8	1.6	2.0	2.
25	2.5	3.8	7.4	2.0	2.5	2.3	1.9	2.0	1.7	1.5	2.0	2.
26	2.5	3.7	6.1	2.9	2.5	2.2	2.9	1.7	1.7	1.5	2.0	2.
27	2.8	3.6	5.3	3.3	3.3	3.6	2.7	1.6	1.8	1.5	1.9	2.
28	3.1	4.3	4.9	3.5	3.5	3.6	2.6	1.5	1.7	1.6	1.9	2.
29	3.0	.....	4.2	3.3	3.1	3.2	2.4	1.4	1.6	1.6	1.9	2.
30	2.9	.....	5.7	3.1	2.8	3.0	2.0	1.3	1.5	1.5	1.9	2.
31	2.6	.....	6.2	.....	2.7	.....	2.0	1.3	.....	1.5	.....	2.
1904.												
1	2.0	2.6	2.9	2.4	2.1	2.9	1.25	.8	1.15	.25	.55	1.
2	2.9	2.5	2.8	2.4	1.9	2.4	1.15	1.2	1.0	.45	.65	1.
3	2.0	2.4	2.9	2.5	1.8	2.3	.8	3.65	.8	.3	.8	1.
4	2.2	2.3	3.0	2.4	1.7	1.5	.6	1.85	1.3	.2	1.3	1.
5	2.4	2.2	2.9	2.0	1.7	1.3	.6	1.45	2.5	.2	1.45	2.
6	2.3	2.2	2.6	2.0	1.7	1.5	.5	1.3	1.7	.2	1.55	1.
7	2.2	2.5	4.0	2.5	1.5	1.4	.4	2.8	1.15	.35	1.35	1.
8	2.1	2.7	4.5	3.0	2.5	1.5	.75	3.1	1.0	.3	.95	1.
9	2.2	2.8	4.9	3.7	2.2	1.5	1.75	4.4	1.1	.35	.95	2.
10	2.2	3.5	4.6	2.9	2.6	1.5	1.7	4.8	1.0	.3	.9	2.

Daily gage height, in feet, of Alcovy River near Covington—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
	2.3	5.5	4.0	2.5	2.9	1.3	1.65	5.7	1.0	0.3	0.85	2.2
	2.5	5.0	3.3	2.3	2.0	1.2	1.6	5.9	.75	.3	.85	2.25
	2.4	4.5	3.0	2.1	1.9	1.1	1.0	4.75	.8	.25	1.5	2.0
	2.6	4.1	3.0	2.0	1.4	1.0	1.2	3.3	.75	.25	1.45	1.95
	2.3	3.8	3.5	2.0	1.4	.9	.9	3.1	.75	.25	1.3	1.7
	2.1	3.6	3.6	2.0	1.5	.8	.75	4.9	.7	.25	1.35	1.7
	2.5	3.2	3.2	2.0	1.4	.6	.7	4.75	.5	.25	1.2	1.8
	2.7	3.0	3.0	2.0	1.5	.6	.5	2.8	.65	.25	1.1	1.7
	2.6	3.4	2.8	2.0	1.3	.5	.6	2.0	.6	.25	1.05	1.7
	2.4	3.7	2.5	2.0	1.3	.4	.7	1.8	.5	.3	1.1	1.6
	3.4	4.2	2.5	2.1	1.3	.4	.9	1.7	.45	.25	1.15	1.6
	3.5	4.7	2.9	2.1	1.3	.7	.5	1.4	.4	.25	1.1	1.5
	4.5	5.0	3.1	2.0	1.2	.6	.7	1.2	.3	.25	1.6	1.5
	4.1	4.7	3.1	2.1	1.2	.5	.8	1.2	.3	.25	1.8	1.5
	3.5	4.4	2.9	2.0	1.1	.5	.7	1.2	.5	.9	2.15	1.75
	3.0	3.9	2.8	2.2	1.1	.5	.6	1.1	.45	.85	2.0	1.85
	2.9	3.4	2.8	2.2	1.1	.45	.5	1.15	.4	.75	1.5	1.8
	2.7	3.2	2.7	2.2	1.1	.4	.4	1.7	.35	.65	1.3	2.1
	2.6	3.0	2.5	2.0	1.0	.75	.6	1.4	.3	.65	1.2	2.6
	2.5	.....	2.3	1.9	1.0	1.3	.5	1.25	.3	.65	1.2	2.9
	2.9	.....	2.3	.....	2.0	.....	.7	1.1	.....	.65	.....	2.75

Rating tables for Alcovy River near Covington.

APRIL 30 TO DECEMBER 31, 1901.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	111	3.00	308	4.60	612	7.40	1,144
1.50	118	3.10	327	4.70	631	7.60	1,182
1.60	126	3.20	346	4.80	650	7.80	1,220
1.70	134	3.30	365	4.90	669	8.00	1,258
1.80	143	3.40	384	5.00	688	8.20	1,296
1.90	152	3.50	403	5.20	726	8.40	1,334
2.00	162	3.60	422	5.40	764	8.60	1,372
2.10	173	3.70	441	5.60	802	8.80	1,410
2.20	185	3.80	460	5.80	840	9.00	1,448
2.30	198	3.90	479	6.00	878	10.00	1,638
2.40	212	4.00	498	6.20	916	11.00	1,828
2.50	226	4.10	517	6.40	954	12.00	2,018
2.60	241	4.20	536	6.60	992	13.00	2,208
2.70	257	4.30	555	6.80	1,030		
2.80	273	4.40	574	7.00	1,068		
2.90	290	4.50	593	7.20	1,106		

JANUARY 1 TO DECEMBER 31, 1902.[b]

1.00	108	1.60	152	2.10	197	2.60	252
1.10	114	1.70	160	2.20	207	2.70	265
1.20	121	1.80	169	2.30	218	2.80	278
1.30	128	1.90	178	2.40	229	2.90	292
1.40	136	2.00	187	2.50	240	3.00	308
1.50	144						

[a] Above gage height 3.0 feet the rating curve is a tangent, the difference being 19 per tenth.
[b] Above gage height 3.0 feet the above table is the same as the 1901 table.

Rating tables for Alcovy River near Covington—Continued.

JANUARY 1 TO DECEMBER 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*
1.30	98	1.80	290	3.30	382	4.70	630
1.40	104	1.90	315	3.40	410	4.80	650
1.50	108	2.00	332	3.50	430	4.90	670
1.60	117	2.10	348	3.60	450	5.00	690
1.70	124	2.20	365	3.70	470	5.20	730
1.80	132	2.30	374	4.00	490	5.40	770
1.90	140	2.40	390	4.10	510	5.60	810
2.00	148	2.50	406	4.20	530	5.80	850
2.10	156	2.60	422	4.30	550	6.00	890
2.20	164	2.70	439	4.40	570	7.00	1,090
2.30	172	2.80	456	4.50	590	8.00	1,290
2.40	180	2.90	474	4.60	610	9.00	1,490
2.50	188						

JANUARY 1 TO DECEMBER 31, 1904.

0.30	38	1.50	135	2.70	259	3.90	460
.40	45	1.60	144	2.80	272	4.00	480
.50	52	1.70	153	2.90	286	4.20	522
.60	59	1.80	162	3.00	300	4.40	564
.70	66	1.90	171	3.10	315	4.60	606
.80	73	2.00	180	3.20	331	4.80	648
.90	80	2.10	190	3.30	347	5.00	690
1.00	87	2.20	201	3.40	364	5.20	734
1.00	95	2.30	212	3.50	382	5.40	778
1.10	103	2.40	223	3.60	401	5.60	822
1.20	111	2.50	234	3.70	420	5.80	866
1.30	119	2.60	246	3.80	440	6.00	910
1.40	127						

[a] At about 6 feet gage height the right bank overflows for a width of about 1,000 feet. Bank is covered by a thick swamp growth, so the velocity is probably small. Above gage height 3.6 the rating curve is a tangent, the difference being 20 per tenth.

Estimated monthly discharge of Alcovy River near Covington.

[Drainage area, 228 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft per sq. mile.	Depth in inches.
1901.					
May	593	162	271	1.19	1.37
June	821	198	442	1.94	2.16
July	840	143	377	1.65	1.90
August	1,030	111	582	2.55	2.94
September	935	152	361	1.58	1.76
October	555	152	228	1.00	1.15
November	273	162	183	.80	.89
December	1,144	162	393	1.72	1.98
1902.					
January	973	265	391	1.72	1.98
February	2,170	422	675	2.96	3.08
March	1,543	479	764	3.31	3.82
April	802	308	496	2.18	2.43
May	403	187	251	1.10	1.27
June	460	121	195	.86	.96
July	441	108	163	.71	.82
August	688	108	193	.85	.98
September	384	108	204	.89	1.00
October	265	144	181	.79	.91
November	517	136	212	.93	1.04
December	745	197	344	1.51	1.74
The year	2,170	108	338	1.48	20.02

Estimated monthly discharge of Alcovy River near Covington—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
January	356	194	262	1.15	1.33
February	1,290	232	691	3.03	3.16
March	1,410	430	689	3.02	3.48
April	950	170	535	2.35	2.62
May	830	232	371	1.63	1.88
June	1,090	194	468	2.05	2.29
July	990	160	375	1.64	1.89
August	590	107	244	1.07	1.23
September	630	86	186	.82	.91
October	170	114	126	.55	.63
November	306	140	178	.79	.88
December	232	150	185	.81	.93
The year	1,410	88	359	1.58	21.23
1904.					
January	585	180	264	1.16	1.34
February	800	201	406	1.78	1.92
March	669	212	331	1.45	1.67
April	420	171	209	.917	1.02
May	286	95	147	.645	.744
June	286	52	105	.460	.513
July	157	52	84.2	.369	.425
August	888	80	290	1.27	1.46
September	234	45	80.8	.354	.395
October	87	38	50.6	.222	.256
November	195	63	115	.504	.562
December	373	103	193	.846	.975
The year	888	38	190	.831	11.28

ALCOVY RIVER NEAR STEWART.

This station was established September 16, 1905, by M. R. Hall. It is located at a wooden wagon bridge known as "Waters Bridge," about 15 miles south of Covington, Ga., and 5 miles from Stewart, below the mouth of Bear Creek and about 4 miles from the mouth of the river. The station is important because it is a short distance below a large amount of fall at the old Newton factory site.

The channel curves to the left bank about 45° in 300 feet above the station, and is straight for 1,000 feet below the station. The right bank is high and will not overflow. The left bank may overflow about 200 feet at high floods. The channel above and below appears to contain much sand, which is shifting, though the bed is mostly rock in the part under the right span of the bridge, to which nearly all of the flow is confined at lowest stage of water.

Discharge measurements are made from the bridge of three spans of about 50 feet each.

A vertical staff gage is attached to a birch tree at the right edge of the water, 12 feet upstream from the bridge. It is read once each day by A. J. White. The bench mark is a cross and circles cut on a solid rock outcrop at the right edge of the water, just under the downstream side of the bridge; elevation, 2.36 feet above the datum of the gage.

Discharge measurements of Alcovy River near Stewart.

Date.	Gage height.	Discharge.	Date.	Gage height.	D ch
1905.	*Feet.*	*Sec.-ft.*	1906.	*Feet.*	*Se*
September 16	1.54	48	January 13	4.80	
Septemb r 16	1.55	48	January 13	4.82	
November 24	2.03	106			
November 24	2.05	105			

Daily gage height, in feet, of Alcovy River near Stewart.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	I
1905.					1905.				
1		1.65	1.95	2.05	17	1.75	1.65	2.1	
2		1.6	1.8	2.05	18	1.7	1.7	2.1	
3		1.6	1.8	6.25	19	1.7	1.7	2.1	
4		1.7	1.6	6.2	20	1.65	1.7	2.1	
5		1.75	1.65	7.5	21	1.6	1.7	2.0	
6		2.0	1.7	7.0	22	1.6	1.7	2.05	
7		2.05	2.05	6.0	23	1.6	1.7	2.0	
8		1.75	1.75	5.3	24	1.55	1.6	2.0	
9		1.75	1.8	6.3	25	1.55	1.65	2.0	
10		1.65	2.1	5.2	26	1.5	1.8	2.1	
11		2.0	3.3	5.2	27	1.5	1.85	2.2	
12		1.8	2.8	5.8	28	1.5	1.85	2.2	
13		1.95	2.8	6.0	29	1.45	1.95	2.05	
14		2.05	2.7	5.2	30	1.5	1.9	2.15	
15		2.0	2.45	4.8	31		1.9		
16	1.55	1.95	2.25	4.2					

Rating table for Alcovy River near Stewart from September 16 to December 31, 190

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	34	2.70	192	4.00	412	5.60	796
1.50	44	2.80	206	4.10	432	5.80	852
1.60	55	2.90	220	4.20	452	6.00	910
1.70	66	3.00	236	4.30	474	6.20	970
1.80	77	3.10	252	4.40	496	6.40	1,030
1.90	88	3.20	268	4.50	518	6.60	1,090
2.00	100	3.30	284	4.60	540	6.80	1,150
2.10	112	3.40	300	4.70	564	7.00	1,210
2.20	124	3.50	318	4.80	588	7.20	1,274
2.30	136	3.60	336	4.90	612	7.40	1,338
2.40	150	3.70	354	5.00	636	7.60	1,402
2.50	164	3.80	372	5.20	688	7.80	1,466
2.60	178	3.90	392	5.40	740		

Estimated monthly discharge of Alcovy River near Stewart.

[Drainage area, 395 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Dep inc
1905.					
September 16–30	72	39	52.9	0.134	
October	106	55	76.5	.194	
November	284	55	117	.296	
December	1,466	106	766	1.94	

TOWALIGA RIVER NEAR JULIETTE.

The drainage basin of this stream occupies a small area in central Georgia, its headwater tributary adjoining those of Flint River on the west, and small creeks draining into the Ocmulgee on the east. The river is a tributary of Ocmulgee River, entering it 25 miles above Macon. The area drained is a rolling country and extensively cultivated. A gaging station was established by B. M. Hall near its mouth, at the Southern Railway bridge, 2½ miles north of Juliette on May 5, 1899, but observations of gage heights were not started until November 2. The station was discontinued December 31, 1901.

At low stages measurements were made at the wagon bridge a half mile above the railroad bridge. W. L. Jackson, a farmer living a half mile from the bridge, was the observer. His address is Berner, Ga. The rod is nailed to the timber crib at the base of the left-bank pier of the iron single-span bridge. Bench mark No. 1 is at the top of the downstream iron girder under the cross-ties 40 feet from the left end of the bridge; elevation, 37.30 feet above gage datum. Bench mark No. 2 is at the top of the rail at the same point; elevation, 38.80 feet above gage datum.

Discharge measurements of Towaliga River near Juliette.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1899.	*Feet.*	*Sec.-ft.*	1901.	*Feet.*	*Sec.-ft.*
May 5	3.45	581	January 14	3.75	563
May 17	2.10	255	February 22	2.70	362
November 2	1.50	167	May 8	2.22	301
November 2	1.50	163	July 27	1.48	172
December 16	1.90	184	September 13	1.55	163
1900.			September 22	2.63	312
February 17	6.35	1,025	November 5	1.65	185
April 3	2.60	348			
December 8	2.75	468			

Daily gage height, in feet, of Towaliga River near Juliette.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1899.			1899.			1899.			1899.		
1		1.7	9	1.2	1.6	17	1.6	1.8	25	1.2	3.8
2	1.2	1.65	10	1.1	1.55	18	1.3	1.7	26	3.35	2.5
3	1.2	1.65	11	1.2	1.5	19	1.3	1.7	27	3.2	2.1
4	1.1	1.75	12	1.1	3.7	20	1.2	1.7	28	2.2	1.1
5	1.1	1.75	13	1.1	3.6	21	1.3	1.7	29	1.95	2.0
6	1.1	1.65	14	1.1	2.5	22	1.2	1.5	30	1.8	1.9
7	1.1	1.55	15	1.1	2.0	23	1.3	1.6	31		1.9
8	1.1	1.5	16	1.7	1.9	24	1.2	4.0			

Daily gage height, in feet, of Towaliga River near Juliette—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	I
1900.												
1	2.2	2.0	2.9	1.8	3.1	2.0	4.0	2.2	4.5	0.9	1.3	
2	2.2	1.9	4.3	1.6	3.6	2.1	4.0	2.2	1.5	1.0	2.0	
3	2.0	1.9	3.1	2.6	4.9	2.1	3.5	1.7	1.9	1.4	8.2	
4	2.0	2.1	2.8	2.8	3.3	3.7	3.5	1.7	1.6	2.1	7.0	
5	1.9	2.7	2.4	2.6	3.1	2.9	4.1	2.3	1.5	3.4	6.4	
6	1.9	2.6	2.4	2.5	2.6	2.5	3.5	1.7	1.3	3.6	3.5	
7	1.9	2.3	1.4	2.7	2.6	3.2	3.3	1.5	1.2	3.9	2.2	
8	1.9	1.4	2.9	2.6	2.5	5.2	4.2	1.3	1.0	3.8	2.1	
9	1.9	2.4	3.4	2.5	2.5	2.4	4.0	1.2	1.0	1.7	2.1	
10	1.9	7.3	2.8	2.5	2.5	2.6	4.0	1.2	1.0	1.5	2.0	
11	1.9	11.8	2.3	3.4	2.4	2.9	3.8	1.2	1.0	1.5	2.0	
12	2.7	14.1	1.3	5.7	2.4	2.3	3.7	1.1	1.0	1.6	1.9	
13	2.8	14.8	2.0	4.0	2.4	2.3	4.4	1.3	1.0	1.7	1.9	
14	2.3	16.5	1.1	2.9	2.3	2.4	3.7	1.0	2.4	1.7	1.9	
15	2.2	16.3	1.0	2.8	2.3	2.3	2.2	1.7	8.0	1.5	1.9	
16	2.1	8.3	4.0	2.7	2.2	2.9	2.0	1.5	6.4	1.4	1.8	
17	2.0	4.8	3.1	2.7	2.2	3.3	1.8	1.3	4.2	1.3	1.8	
18	2.1	3.8	2.3	12.8	2.2	3.8	1.0	1.9	3.1	1.1	1.8	
19	2.8	3.3	1.1	17.8	2.2	4.1	1.0	1.3	2.9	1.1	2.0	
20	3.2	3.2	3.3	14.8	2.2	5.2	1.0	1.2	2.0	1.1	1.9	
21	2.9	2.4	3.1	7.8	2.2	2.2	1.0	1.1	1.4	1.1	1.8	
22	2.5	4.0	2.3	12.8	2.1	1.9	1.5	0.8	1.3	1.1	1.8	
23	2.3	3.3	2.2	5.5	2.1	2.2	1.5	0.9	1.2	2.4	1.9	
24	2.2	2.9	2.7	4.8	2.8	9.8	2.2	2.1	1.3	3.6	1.9	
25	2.2	2.4	3.4	4.1	2.9	10.8	1.9	3.0	1.3	3.5	2.5	
26	2.1	3.0	4.0	3.6	2.5	8.8	1.6	4.3	1.2	2.9	4.4	
27	2.0	2.9	3.6	3.4	2.4	6.8	2.4	2.6	1.2	2.1	3.1	
28	2.1	2.4	2.8	3.2	2.4	6.6	2.5	1.5	1.1	1.5	2.4	
29	2.0	.....	2.4	3.3	2.2	6.2	4.0	1.2	1.1	1.3	2.3	
30	2.0	.....	2.4	3.2	2.1	4.2	5.1	1.6	0.8	1.2	1.9	
31	2.1	.....	2.1	.....	2.1	.....	3.4	5.5	.....	1.2	.....	
1901.												
1	5.1	2.8	2.7	8.8	2.5	5.6	2.0	2.0	3.4	2.6	1.5	
2	5.9	3.0	2.7	11.7	2.4	3.7	3.0	3.0	2.5	2.6	1.5	
3	7.2	3.4	2.6	13.9	2.4	2.8	2.2	1.7	2.1	3.0	1.6	
4	5.4	8.3	2.5	12.0	2.3	2.5	2.0	1.6	2.0	2.2	1.6	
5	4.8	8.8	2.5	5.6	2.3	2.3	2.0	1.5	1.8	2.0	1.5	
6	4.3	4.6	2.5	4.7	2.3	2.3	1.8	1.4	1.5	2.0	1.5	
7	4.1	3.5	2.4	4.2	2.2	5.0	2.2	2.6	1.5	2.0	1.5	
8	4.3	5.2	2.4	3.9	2.1	3.8	1.8	2.4	1.5	1.9	1.5	
9	3.9	5.9	2.4	3.5	2.1	2.4	9.2	1.9	1.4	1.8	1.5	
10	3.9	6.0	4.1	3.4	2.1	2.2	2.8	1.8	1.4	1.8	1.5	
11	3.5	5.8	4.1	3.3	2.1	2.2	2.4	4.6	1.5	1.8	1.5	
12	5.1	4.6	2.9	3.2	2.1	2.1	2.2	3.4	1.5	2.0	1.4	
13	5.8	3.6	3.4	4.3	2.1	3.6	2.0	3.1	1.5	1.7	1.4	
14	4.3	3.3	3.1	4.6	2.1	4.0	2.0	2.4	1.8	1.7	1.4	
15	2.9	3.0	3.1	4.0	2.1	5.0	2.0	4.3	1.6	1.7	1.4	
16	2.5	3.0	2.6	3.6	2.1	5.6	2.1	6.1	1.5	1.7	1.4	
17	7.1	2.9	2.9	3.2	2.1	4.5	2.1	11.2	12.2	1.7	1.5	
18	5.8	2.8	2.8	3.1	2.1	3.3	2.0	4.2	7.6	1.7	1.4	
19	3.6	2.7	2.7	4.6	2.1	2.5	9.1	3.1	3.6	1.7	2.0	
20	3.3	2.7	2.5	4.0	2.6	2.3	3.5	4.2	3.0	1.6	2.4	
21	3.1	2.7	2.9	3.4	3.5	2.2	1.8	3.1	3.0	1.5	2.3	
22	3.0	2.6	2.6	3.1	7.6	2.2	1.6	2.6	2.7	1.5	2.1	
23	2.8	2.8	2.4	2.9	7.1	3.0	1.5	5.9	2.4	1.5	1.7	
24	2.8	3.0	2.9	2.9	3.5	4.5	2.6	9.0	2.3	1.5	1.7	
25	3.0	3.0	3.1	2.8	3.4	3.4	2.2	4.6	2.1	1.5	1.7	
26	2.8	3.0	6.3	2.8	2.8	2.2	1.5	4.5	1.8	1.5	1.7	
27	3.0	3.0	11.6	2.8	2.5	2.3	1.4	3.4	1.8	1.5	1.7	
28	2.8	2.7	5.3	2.7	2.5	2.3	1.3	2.4	2.0	1.5	1.7	
29	3.0	.....	4.0	2.7	2.4	2.1	1.8	4.5	3.4	1.5	1.7	1
30	3.0	.....	3.6	2.7	2.3	2.0	2.4	3.1	3.0	1.5	1.7	
31	2.8	.....	9.2	.....	4.8	.....	2.0	2.6	.....	1.5	.....	

ing table for Towaliga River near Juliette from November 2, 1899, to December 31, 1901.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	120	2.20	273	4.40	669	10.00	1 677
1.10	127	2.40	309	4.60	705	11.00	1,857
1.20	135	2.60	345	4.80	741	12.00	2,037
1.30	144	2.80	381	5.00	777	13.00	2,217
1.40	154	3.00	417	5.50	867	14.00	2,397
1.50	165	3.20	453	6.00	957	15.00	2,577
1.60	177	3.40	489	6.50	1,047	16.00	2,757
1.70	190	3.60	525	7.00	1,137	17.00	2,937
1.80	204	3.80	561	7.50	1,227	18.00	3,117
1.90	220	4.00	597	8.00	1,317		
2.00	237	4.20	633	9.00	1,497		

[a] Above gage height 2.0 feet the rating curve is a tangent, the difference being 18 per tenth.

Estimated monthly discharge of Towaliga River near Juliette.

[Drainage area, 350 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1899.					
ember 2 to 30	480	127	170	0.49	0.53
ember	597	127	248	.71	.82
1900.					
uary	453	220	274	.78	.90
ruary	2,847	154	1,449	4.14	4.31
rch	597	120	354	1.01	1.16
il	3,081	177	751	2.15	2.40
y	759	255	422	1.21	1.40
e	1,821	220	595	1.70	1.90
y	795	120	408	1.17	1.35
gust	867	109	222	.63	.73
tember	1,317	109	271	.77	.86
ober	579	114	243	.69	.80
vember	1,353	144	357	1.02	1.14
ember	1,497	220	526	1.50	1.73
The year	3,081	109	489	1.40	18.68
1901.					
uary	1,173	327	602	1.72	1.98
ruary	1,461	345	576	1.65	1.72
rch	1,965	309	520	1.49	1.72
il	2,379	363	707	2.02	2.25
y	1,245	255	390	1.09	1.26
e	885	237	440	1.26	1.41
y	1,533	144	337	.96	1.11
gust	1,893	154	531	1.52	1.75
tember	1,245	154	360	1.03	1.15
ober	417	165	209	.60	.69
vember	309	154	185	.53	.59
ember	1,857	190	475	1.36	1.57
The year	2,379	144	444	1.27	17.20

MIDDLE OCONEE RIVER NEAR ATHENS.

Middle Oconee River rises in Hall County and flows southeastward rough Jackson and Clarke counties to its junction with the East rk, 6 miles below Athens. It drains a rolling area of 300 square les.

Measurements were begun at Athens on October 11, 1901, the sta- n having been established by Prof. C. M. Strahan, of the University

of Georgia. It is located on a wagon bridge, known as Mitcl Bridge, on the Athens and Lawrenceville road, 3½ miles from Atl and about 7½ miles above the junction of Middle Oconee with eastern fork. It is 4 miles above the dam of the Princeton factory 8-foot shoal intervening, and one-third of a mile below the dam of Athens Electric Railway Company. The station was discontinue October 25, 1902.

The channel is straight and unobstructed except by remain old piers just inside the present piers, the old piers being covered gage height of 3 feet. The banks are high and the approaches sh The water rises rapidly in time of flood, the maximum gage hei being 22.9 feet and the average gage height 2.5 to 3 feet.

Discharge measurements were made from the bridge, which is of covered wooden lattice type. The initial point for soundings spike at the west end of the north bridge truss. The gage is of w mounted on the north truss, near the east end of the bridge. T protected by a plank cover and locked. The bench mark is the to the lower chord at the gage pulley, 26.85 feet above the river bott which is the zero point of the gage, the latter being set to read when the weight touches the bottom. The graduations are laid on the lower chord 20 feet and can be extended to 26 feet.

Discharge measurements of Middle Oconee River at Athens.

Date.	Gage height.	Discharge.	Date.	Gage height.	D ch
1901.	*Feet.*	*Sec.-ft.*	1902.	*Feet.*	*Se*
October 11	2.80	498	February 28	22.50	
October 26	2.80	491	May 2	(a)	
December 31	11.18	6,779	June 30	1.70	
			July 17	2.10	
1902.			July 19	1.95	
January 3	3.65	855	July 22	1.85	

a Gaging made 7 miles above Athens.

Daily gage height, in feet, of Middle Oconee River, near Athens.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	I
1901.				1901.			
1		2.8	2.7	17	2.8	2.7	
2		2.7	2.7	18	2.8	2.7	
3		2.7	3.1	19	2.8	2.8	
4		2.8	3.1	20	2.8	3.0	
5		2.9	2.9	21	2.8	2.9	
6		2.8	2.9	22	2.8	2.8	
7		2.8	2.8	23	2.8	2.8	
8		2.8	2.8	24	2.8	2.8	
9		2.7	2.8	25	2.8	2.7	
10		2.7	3.0	26	2.8	2.7	
11	2.8	2.7	3.0	27	2.7	2.7	
12	2.9	2.8	2.8	28	2.8	2.6	
13	2.9	2.8	2.8	29	2.8	2.7	
14	3.0	2.8	2.9	30	2.8	2.7	
15	2.9	2.8	4.3	31	2.8		
16	2.9	2.7	3.5				

Daily gage height, in feet, of Middle Oconee River, near Athens.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.										
.....	4.2	6.2	19.0	3.0	2.5	2.1	1.7	1.8	1.7	2.2
.....	3.9	14.0	7.3	3.2	2.5	2.1	1.7	1.8	1.7	2.3
.....	3.7	17.0	5.7	3.0	2.5	2.1	2.1	2.9	1.7	2.4
.....	3.5	5.5	5.2	2.9	2.4	2.0	2.0	2.0	1.7	1.9
.....	3.5	4.2	4.8	2.9	2.4	2.0	1.9	2.7	1.7	2.3
.....	3.5	3.9	4.6	2.9	2.4	2.0	1.8	2.0	1.7	2.3
.....	3.4	3.8	4.4	2.9	2.4	2.4	1.8	2.0	1.6	2.1
.....	3.4	3.8	3.8	3.0	2.4	2.3	1.8	1.9	1.6	1.9
.....	3.3	3.6	3.6	3.0	2.3	2.2	1.8	1.8	2.1	1.8
.....	3.3	3.5	3.6	2.9	2.3	2.1	1.8	1.8	2.1	1.8
.....	3.3	3.5	3.3	2.9	2.3	2.1	1.9	1.7	1.9	1.8
.....	3.2	3.4	3.3	2.8	2.3	2.0	2.0	2.1	1.8	2.3
.....	3.2	3.4	4.0	2.8	2.3	2.0	2.5	2.0	2.5	2.3
.....	3.2	3.4	3.5	2.8	2.3	2.0	3.8	1.9	2.3	2.1
.....	3.2	3.6	3.4	2.8	2.3	2.2	2.3	1.8	1.9	2.0
.....	3.2	3.7	5.3	2.8	2.2	2.4	2.2	1.7	1.6	1.9
.....	3.2	3.6	8.4	3.2	2.2	2.2	2.1	1.7	1.6	1.9
.....	3.1	3.5	4.7	3.7	2.2	2.1	2.0	1.7	1.6	1.8
.....	3.2	3.5	3.6	3.0	2.2	2.1	1.9	1.7	1.8	1.8
.....	3.3	3.6	3.3	2.8	2.2	2.0	1.8	1.7	2.1	1.8
.....	3.3	3.7	3.1	2.8	2.2	2.0	1.8	1.7	1.9	1.8
.....	3.2	3.7	3.0	2.8	2.2	2.0	1.9	1.7	1.7	1.8
.....	3.2	3.5	2.9	2.7	2.2	2.0	1.9	1.6	1.7	1.8
.....	3.2	3.5	2.9	2.7	2.2	1.9	1.9	1.6	1.6	1.8
.....	3.2	4.0	2.9	2.6	2.2	1.9	2.2	1.6	3.6	1.8
.....	3.2	4.3	2.9	2.6	2.2	1.8	1.8	1.6	5.6	.....
.....	3.2	3.8	2.9	2.6	2.2	1.8	2.0	1.6	3.9	.....
.....	3.4	25.5	3.4	2.5	2.1	1.8	2.3	1.6	3.0	.....
.....	4.4	.....	11.3	2.5	2.1	1.8	2.0	1.7	2.1	.....
.....	3.9	.....	18.6	2.6	2.1	1.7	1.8	1.7	2.0	.....
.....	4.3	.....	4.6	.....	2.1	.....	1.8	1.7	.....	.....

Rating tables for Middle Oconee River, near Athens.

OCTOBER 11 TO DECEMBER 31, 1901.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	430	4.50	1,261	6.80	2,822	11.50	7,050
2.70	464	4.60	1,315	7.00	3,000	12.00	7,500
2.80	499	4.70	1,370	7.20	3,180	12.50	7,950
2.90	535	4.80	1,426	7.40	3,360	13.00	8,400
3.00	572	4.90	1,483	7.60	3,540	13.50	8,850
3.10	610	5.00	1,541	7.80	3,720	14.00	9,300
3.20	650	5.10	1,600	8.00	3,900	15.00	10,200
3.30	691	5.20	1,661	8.20	4,080	16.00	11,100
3.40	733	5.30	1,723	8.40	4,260	17.00	12,000
3.50	776	5.40	1,786	8.60	4,440	18.00	12,900
3.60	820	5.50	1,850	8.80	4,620	19.00	13,800
3.70	865	5.60	1,915	9.00	4,800	20.00	14,700
3.80	911	5.70	1,982	9.20	4,980	21.00	15,600
3.90	958	5.80	2,050	9.40	5,160	22.00	16,500
4.00	1,006	5.90	2,119	9.60	5,340	23.00	17,400
4.10	1,055	6.00	2,190	9.80	5,520	24.00	18,300
4.20	1,105	6.20	2,336	10.00	5,700	25.00	19,200
4.30	1,156	6.40	2,490	10.50	6,150		
4.40	1,208	6.60	2,652	11.00	6,600		

JANUARY 1 TO OCTOBER 25, 1902.[b]

1.60	243	2.40	439	3.20	755	4.00	1,046
1.70	275	2.50	531	3.30	787	4.10	1,088
1.80	307	2.60	563	3.40	819	4.20	1,131
1.90	339	2.70	595	3.50	851	4.30	1,174
2.00	371	2.80	627	3.60	884	4.40	1,217
2.10	403	2.90	659	3.70	929	4.50	1,261
2.20	435	3.00	691	3.80	966		
2.30	467	3.10	723	3.90	1,005		

[a] Above gage height 7.0 feet the rating curve is a tangent, the difference being 90 per tenth.
[b] Above gage height 4.5 feet, this table is the same as the 1901 table.

Estimated monthly discharge of Middle Oconee River, near Athens.

[Drainage area, 395 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.					
October 11–31	572	464	508	1.29	[illegible]
November	572	430	486	1.23	[illegible]
December	12,900	464	1,373	3.48	[illegible]
1902.					
January	1,217	723	837	2.12	[illegible]
February	19,560	819	2,362	5.98	[illegible]
March	13,800	659	2,189	5.54	[illegible]
April	884	531	652	1.65	[illegible]
May	531	403	458	1.16	[illegible]
June	499	275	383	.97	[illegible]
July	966	275	375	.95	[illegible]
August	659	243	317	.80	[illegible]
September	1,915	243	426	1.08	[illegible]
October 1–25	499	307	367	.93	[illegible]

OCONEE RIVER AT BARNETT SHOALS.

This station was established by Prof. C. M. Strahan, of the University of Georgia, on August 6, 1901, and was discontinued on August 23, 1902, for want of an observer. It was located at Barnetts Bridge, 1 mile above Barnett Shoals and 4 miles east of Watkinsville. Discharge measurements were made from the downstream side of the bridge, which is a covered lattice single-span bridge, with a total length of 109 feet between abutments. The observer was R. L. McRee, a storekeeper at Barnett Shoals, who read the gage once daily at ordinary stages and twice daily during low stages, when the regularity of the flow is affected by the small dam of the Georgia factory, 6½ miles upstream. The gage is a 10-foot rod nailed to a tree on the left bank just above the bridge, and extended to a length of 16 feet by means of a plank marked in feet fastened above. The bench mark is a large nail driven into the tree; elevation, 6.00 feet above the datum of the gage.

Discharge measurements of Oconee River at Barnett Shoals.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1902.	*Feet.*	*Sec.-ft.*
May 2	1.40	1,025	January 1	6.35	[illegible]
August 6	2.70	1,461	March 22	3.20	[illegible]
August 13	4.53	1,882	May 31	2.10	[illegible]
September 6	2.22	825	June 28	1.77	[illegible]
September 20	4.77	2,832			
October 19	2.05	806			
December 10	12.10	16,670			

Daily gage height, in feet, of Oconee River at Barnett Shoals.

ay.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
01.						1901.					
.....	.....	3.3	2.3	2.0	2.1	17.....	6.0	6.4	2.1	2.0	3.0
.....	.....	3.0	3.5	2.0	2.1	18.....	3.8	8.3	2.1	2.0	2.6
.....	.....	2.7	3.9	2.0	2.0	19.....	4.8	8.6	2.05	2.1	2.3
.....	.....	2.5	3.0	2.0	2.3	20.....	5.9	4.7	2.1	2.2	2.2
.....	.....	2.4	2.5	2.0	2.2	21.....	4.8	3.2	2.1	2.2	2.1
.....	.....	2.3	2.3	2.0	2.1	22.....	8.3	2.8	2.1	2.1	2.0
.....	.....	2.3	2.2	2.0	2.0	2..	9.7	2.6	2.05	2.	2.3
.....	.....	2.2	2.1	2.0	2.0	24.....	7.0	2.5	2.1	2.	2.2
.....	.....	2.2	2.1	2.0	2.0	25.....	4.0	2.4	2.0	2.0	2.1
.....	.....	2.2	2.2	2.0	2.4	26.....	3.4	2.4	2.0	2.0	2.0
.....	.....	2.5	2.2	2.0	2.3	27.....	6.5	2.3	2.0	2.	3.0
.....	.....	2.3	2.1	2.0	2.2	28.....	6.3	2.5	2.0	2.	5.0
.....	4.6	2.3	2.2	2.0	2.2	29.....	6.3	2.7	2.0	2.2	10.0
.....	4.1	2.2	2.2	2.0	3.0	30.....	4.5	2.5	2.0	2.	12.0
.....	4.1	2.1	2.3	2.0	5.0	31.....	3.4	.....	2.0	.....	9.5
.....	6.1	2.2	2.2	2.0	4.0						

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1902.								
.....	5.8	8.0	14.0	.....	.....	2.2	1.5	1.6
.....	4.0	14.0	8.0	.....	.....	2.1	1.5	1.6
.....	3.0	10.0	6.0	.....	.....	2.1	1.5	2.4
.....	2.9	8.9	5.0	.....	.....	2.1	2.6	2.4
.....	2.8	7.6	4.5	.....	.....	2.0	2.7	3.9
.....	2.7	6.0	4.0	.....	.....	2.0	1.8	2.5
.....	2.6	4.8	3.6	.....	.....	2.2	1.8	1.9
.....	2.5	3.9	3.0	.....	.....	3.0	1.9	1.7
.....	2.4	3.3	.....	.....	.....	2.3	1.7	1.6
.....	2.4	3.0	.....	.....	.....	2.2	1.9	1.6
.....	2.4	2.8	.....	.....	.....	2.1	2.5	1.8
.....	2.4	2.7	.....	.....	.....	2.1	2.4	2.4
.....	2.4	2.7	.....	.....	.....	1.9	3.2	1.8
.....	2.3	2.7	.....	.....	.....	1.8	2.2	1.6
.....	2.3	3.0	.....	.....	.....	1.9	4.3	1.8
.....	2.3	3.3	.....	.....	.....	2.5	4.3	1.6
.....	2.3	3.3	.....	.....	.....	2.2	2.5	1.7
.....	2.3	3.2	.....	.....	.....	2.1	2.0	1.7
.....	2.4	3.0	.....	.....	.....	2.0	1.9	1.5
.....	2.3	2.8	.....	.....	2.2	2.7	1.8	1.7
.....	2.5	2.6	.....	.....	2.2	2.0	1.7	1.8
.....	2.4	2.6	.....	.....	2.2	1.8	1.7	1.9
.....	2.3	2.5	.....	.....	2.2	1.8	1.6	1.6
.....	2.6	2.5	.....	.....	2.3	1.7	1.6	.....
.....	2.5	2.5	.....	.....	2.3	1.7	1.6	.....
.....	2.4	2.5	.....	.....	2.3	1.7	1.8	.....
.....	2.5	8.0	.....	.....	2.2	1.7	1.7	.....
.....	2.6	17.0	.....	.....	2.1	1.6	1.7	.....
.....	2.9	.....	.....	.....	2.1	1.7	2.0	.....
.....	3.6	.....	.....	.....	2.0	1.7	1.8	.....
.....	4.0	.....	.....	.....	2.0	.....	1.7	.....

Rating tables for Oconee River at Barnett Shoals.

AUGUST 13 TO DECEMBER 31, 1901.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	780	3.80	1,878	5.60	3,835	8.80	9,946
2.10	824	3.90	1,958	5.70	3,980	9.00	10,350
2.20	870	4.00	2,060	5.80	4,130	9.50	11,360
2.30	918	4.10	2,145	5.90	4,285	10.00	12,370
2.40	968	4.20	2,233	6.00	4,445	10.50	13,380
2.50	1,020	4.30	2,324	6.20	4,780	11.00	14,390
2.60	1,074	4.40	2,418	6.40	5,135	11.50	15,400
2.70	1,130	4.50	2,515	6.60	5,510	12.00	16,410
2.80	1,188	4.60	2,615	6.80	5,906	12.50	17,420
2.90	1,248	4.70	2,719	7.00	6,310	13.00	18,430
3.00	1,310	4.80	2,827	7.20	6,714	13.50	19,440
3.10	1,374	4.90	2,939	7.40	7,118	14.00	20,450
3.20	1,440	5.00	3,055	7.60	7,522	15.00	22,470
3.30	1,508	5.10	3,175	7.80	7,926	16.00	24,490
3.40	1,578	5.20	3,299	8.00	8,330	17.00	26,510
3.50	1,650	5.30	3,427	8.20	8,734		
3.60	1,724	5.40	3,559	8.40	9,138		
3.70	1,800	5.50	3,695	8.60	9,542		

JANUARY 1 TO AUGUST 23, 1902.[b]

1.50	520	1.80	665	2.10	813	2.40	967
1.60	568	1.90	713	2.20	864	2.50	1,020
1.70	616	2.00	763	2.30	915		

[a] Above gage height 6.8 feet the rating curve is a tangent, the difference being 202 per tenth.
[b] Above gage height 2.50 feet this table is the same as the 1901 table.

Estimated monthly discharge of Oconee River at Barnett Shoals.

[Drainage area, 835 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.					
August 13–31	11,760	1,578	4,092	4.90	3.4
September	9,542	824	1,763	2.11	2.3
October	1,958	780	916	1.10	1.2
November	918	780	801	.96	1.0
December	16,410	780	2,294	2.75	3.1
1902.					
January	4,130	915	1,211	1.45	1.6
February	26,510	1,020	4,456	5.34	5.5
March 1–3	20,450	1,310	5,486	6.57	1.9
May 29–31	915	763	851	1.02	.4
June	1,310	568	748	.90	1.0
July	2,324	520	842	1.01	1.1
August 1–23	1,958	520	736	.88	.7

OCONEE RIVER NEAR GREENSBORO.

This station was established July 25, 1903, by M. R. Hall. It is located at the new wagon bridge, about 5 miles west of Greensboro, on the road to Madison.

Ordinarily the river is about 120 feet wide, with sandy and shifting bed. The channel is nearly straight, and the current is regular. The right bank is high and rocky, with the exception of a low bench under the bridge and approach. The left bank is low and will overflow at a ge height of about 12 to 15 feet to the end of the approach for a

distance of about 600 feet and at extreme high water may pass beyond the end of the approach.

Discharge measurements are made from the downstream side of the bridge, the initial point for soundings being the end of the iron trestle on the right bank, downstream side. The bridge is of two spans: The first span from the right bank is 80 feet long, and is not over the water except at time of floods; the main span over the river is 144 feet long. There are also 52 feet of iron trestle and about 40 feet of wooden trestle on the right bank, and 253 feet of iron trestle and about 325 feet of wooden trestle on the left bank.

A standard chain gage is fastened to the lower chord of the downstream side of the bridge 163 to 165 feet from the initial point for soundings; length of chain, 38.73 feet. The gage is read once each day by M. A. Stevens, except during three months of the low-water period, when it is read twice each day. Bench marks were established as follows: (1) The top of the downstream end of the second floor beam from the right-bank pier; elevation, 36.00 feet; (2) a copper plug set in the rock under the upstream side of the bridge opposite a point 84 feet from the initial point for soundings; elevation, 13.55 feet.

Discharge measurements of Oconee River near Greensboro.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
June 12	4.00	1,521	October 13	0.51	302
July 25	1.75	733	October 13	.50	291
August 28	1.70	665	November 26	1.35	523
October 9	1.70	690	November 26	1.28	494
December 2	1.66	725	1905.		
1904.			March 23	2.32	826
February 19	2.75	1,066	May 11	2.48	886
March 19	2.75	1,023	June 8	1.36	519
May 12	1.90	753	June 8	1.30	514
June 9	1.57	617	September 7	.77	338
July 13	.99	455	September 7	.74	331
August 9	9.82	5,017	October 30	.74	328
August 9	10.49	5,435	October 30	.73	325
September 21	.45	297	November 25	1.03	407
September 21	.45	301			

Daily gage height, in feet, of Oconee River near Greensboro.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.							1903.						
1	.....	1.9	1.6	1.6	1.6	1.8	17	.....	4.1	8.9	1.8	1.9	1.8
2	.....	4.5	1.4	1.5	1.6	1.7	18	.....	9.6	6.8	1.7	1.7	1.7
3	.....	6.9	1.4	1.5	1.8	1.6	19	.....	13.2	5.2	1.7	1.9	1.7
4	.....	5.6	1.4	1.5	3.7	1.5	20	.....	5.8	2.6	1.6	2.0	1.6
5	.....	4.0	1.4	1.5	2.8	1.5	21	.....	3.5	2.1	1.6	2.1	1.6
6	.....	2.9	1.3	1.5	3.7	1.6	22	.....	2.9	2.2	1.5	1.8	1.8
7	.....	2.2	1.3	1.6	2.6	1.6	23	.....	2.6	2.0	1.5	1.6	1.8
8	.....	2.1	1.2	1.8	2.4	1.8	24	.....	2.1	1.9	1.5	1.6	2.4
9	.....	1.9	1.2	1.7	2.1	2.0	25	.....	1.9	1.8	1.5	1.9	2.2
10	.....	2.5	1.7	1.7	2.1	1.9	26	1.6	1.9	1.8	1.5	1.9	2.2
11	.....	2.1	1.8	1.4	1.9	1.9	27	1.6	1.8	1.7	1.5	1.8	2.0
12	.....	1.5	1.4	1.4	1.9	1.8	28	1.7	1.8	1.6	1.4	1.7	2.1
13	.....	1.5	.9	1.3	1.8	1.7	29	1.6	1.6	1.6	1.3	1.6	2.0
14	.....	4.1	1.2	1.2	1.8	1.7	30	2.0	1.5	1.6	1.3	1.6	1.8
15	.....	2.5	1.8	1.3	1.9	1.9	31	2.4	1.5	.....	1.5	.....	1.8
16	.....	5.0	10.2	1.5	1.7	2.0							

Daily gage height, in feet, of Oconee River near Greensboro—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
1	1.8	2.0	3.1	2.6	1.8	3.1	2.5	2.6	1.5	0.4	0.7	1.4
2	1.8	2.2	2.8	2.6	1.8	2.6	1.7	2.7	1.5	.3	.8	1.6
3	2.0	2.3	3.0	2.4	1.7	2.0	1.5	2.4	1.7	.3	.5	1.8
4	1.8	2.4	3.4	2,3	1.5	1.4	1.0	2.0	2.0	.4	1.2	1.7
5	1.8	2.5	3.4	2.3	1.5	1.2	.9	1.4	3.8	.6	1.3	1.6
6	1.6	2.5	3.4	2.2	1.6	1.0	.9	3.4	2.8	.5	1.0	4.5
7	1.7	2.3	6.0	2.7	1.6	1.0	.8	3.2	1.9	.4	.9	4.7
8	1.8	5.1	7.9	2.8	1.6	1.8	.8	3.7	1.8	.4	.9	3.4
9	1.8	5.5	7.6	3.8	1.7	1.3	1.1	9.3	1.2	.3	.7	2.2
10	1.9	4.0	4.3	3.0	1.8	1.2	1.0	11.9	1.0	.2	.6	1.9
11	2.0	8.5	3.8	2.5	4.5	1.1	1.7	10.0	1.0	.6	.6	2.0
12	2.0	6.2	3.6	2.4	2.0	2.3	1.5	5.3	.9	.6	.6	2.6
13	2.1	4.2	3.4	2.2	2.0	1.3	1.1	3.8	.9	.5	1.6	1.8
14	2.0	3.9	3.1	2.1	1.8	1.2	.9	2.8	.9	.5	1.4	1.7
15	2.0	3.3	4.8	2.2	1.8	1.1	.8	2.4	.8	.2	1.2	1.7
16	1.9	3.2	3.5	2.1	1.7	.9	.7	3.9	.7	.1	1.2	1.5
17	2.5	2.8	3.2	2.2	1.8	.9	.7	2.7	.7	.2	1.2	1.4
18	2.0	2.7	2.8	2.2	1.6	1.0	.7	2.1	.6	.2	1.1	1.8
19	2.0	3.0	2.7	2.3	1.5	.9	.7	1.7	.6	.4	1.1	1.7
20	1.8	4.7	2.5	2.0	1.3	.7	.7	1.6	.6	.4	1.0	1.7
21	2.2	4.9	2.7	2.0	1.2	1.2	.8	1.5	.5	.5	.8	1.5
22	2.0	6.7	3.7	2.0	1.2	2.1	1.7	1.6	.5	.5	.8	1.5
23	2.2	5.2	4.3	2.4	1.1	1.5	1.2	1.5	.5	.6	1.0	1.5
24	4.7	4.8	3.7	2.0	1.1	1.4	1.0	1.5	.5	.1	1.5	1.4
25	4.8	4.5	3.4	2.0	1.0	1.0	1.1	1.4	.4	.1	1.8	1.2
26	3.0	4.0	3.3	2.0	1.0	1.0	1.1	1.3	.4	.2	1.4	1.2
27	2.5	3.4	3.6	3.5	.9	.9	1.0	1.8	.5	.1	1.2	1.4
28	2.4	3.4	3.1	3.0	1.0	.7	1.0	1.8	.6	.8	1.0	3.3
29	2.3	3.0	2.8	2.8	1.1	1.0	.9	1.8	.5	.6	1.0	3.5
30	2.3	.....	2.7	2.6	1.2	2.7	.8	1.6	.4	.5	1.3	2.8
31	2.1	.....	2.6	.....	2.8	.....	3.7	1.6	.....	.4	.....	2.2
1905.a												
1	2.2	1.9	3.2	2.1	2.0	2.3	2.2	1.4	1.25	.4	.7	1.3
2	2.1	2.0	3.1	2.1	2.0	2.0	2.0	1.3	1.85	.15	.65	1.1
3	2.0	2.0	2.9	1.9	2.6	2.0	6.8	1.3	1.3	.85	.7	8.1
4	1.9	2.1	2.8	2.0	4.1	1.8	2.8	1.0	1.1	1.55	.65	11.6
5	1.7	2.2	2.8	2.1	5.4	1.7	2.1	.7	1.4	1.3	.55	13.3
6	1.5	2.4	2.7	2.1	4.5	1.7	3.0	.4	1.15	1.15	.6	11.2
7	2.0	2.0	2.7	2.4	5.6	1.6	6.0	.3	.9	.85	.7	4.0
8	2.7	4.0	2.6	2.2	4.0	1.4	11.2	.6	.85	.8	.7	3.8
9	2.4	4.8	2.6	2.2	3.6	1.3	5.0	1.4	.8	.9	.95	8.1
10	2.0	6.9	2.7	2.0	3.0	1.1	3.1	4.3	.65	1.05	1.2	11.8
11	1.9	7.2	2.6	2.0	2.5	1.1	2.8	3.4	.40	1.25	2.55	12.4
12	1.5	8.0	2.6	2.1	2.2	1.2	5.1	4.4	.9	.95	2.0	8.2
13	3.0	11.4	2.7	2.0	2.0	1.2	4.4	4.6	1.1	1.25	1.85	5.4
14	8.5	12.5	3.2	2.0	1.9	1.5	4.3	4.3	.95	1.2	1.7	3.4
15	6.2	10.7	3.0	1.9	1.6	1.5	3.6	5.4	.95	.9	1.35	4.2
16	4.3	6.2	2.6	2.0	2.0	1.6	2.9	5.6	.8	.85	1.25	4.5
17	3.7	4.9	2.6	2.0	2.0	2.2	2.1	5.6	.65	1.1	1.2	3.9
18	2.7	4.0	2.4	1.9	2.0	2.0	2.0	4.6	.35	1.05	1.05	3.4
19	2.5	3.7	2.4	1.8	1.7	1.8	1.7	2.2	.8	1.05	1.0	3.2
20	2.5	4.2	2.4	1.8	1.5	1.8	1.8	2.4	.8	1.05	1.05	4.0
21	2.5	8.1	2.8	1.7	1.6	1.7	1.8	1.7	.6	.95	1.15	12.7
22	2.3	9.6	2.7	1.7	1.6	1.6	1.7	1.7	.6	.50	1.25	14.0
23	2.3	10.3	2.4	1.8	2.0	2.7	1.4	1.5	.55	.45	1.3	10.5
24	2.1	7.0	2.4	1.8	7.5	2.8	1.6	1.7	.35	.7	1.3	6.6
25	1.9	5.2	2.3	1.7	6.5	2.4	1.9	3.4	.20	.75	1.3	5.8
26	1.7	4.2	2.3	1.7	4.1	2.0	1.9	4.4	.50	.8	1.35	4.8
27	1.7	3.5	2.1	1.7	3.2	1.5	1.8	2.2	.45	.8	1.4	3.6
28	1.5	3.2	2.3	1.7	2.8	1.5	1.5	1.75	.4	.75	1.8	3.4
29	1.8	.....	2.3	1.6	2.6	1.8	1.4	1.6	.45	.7	1.4	4.0
30	1.7	.....	2.2	1.7	2.5	2.0	1.2	1.15	.5	.55	1.3	4.0
31	1.9	.....	2.1	.....	2.3	.....	1.0	1.1	.....	.6	.....	3.8

a On account of a daily fluctuation caused by developed powers above, two readings a day were made during the last four months of 1905. The low days during this period can be attributed to stored water, and do not represent the natural flow.

Rating table for Oconee River near Greensboro.

JULY 26, 1903, TO DECEMBER 31, 1904.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.10	215	1.20	510	2.60	996	6.00	2,550
.20	235	1.30	540	2.80	1,068	6.50	2,830
.40	255	1.40	570	3.00	1,140	7.00	3,120
.30	280	1.50	605	3.20	1,220	8.00	3,740
.50	305	1.60	640	3.40	1,300	9.00	4,410
.60	330	1.70	675	3.60	1,384	10.00	5,100
.70	360	1.80	710	3.80	1,472	11.00	5,830
.80	390	1.90	745	4.00	1,560	12.00	6,600
.90	420	2.00	780	4.50	1,780		
1.00	450	2.20	852	5.00	2,020		
1.10	480	2.40	924	5.50	2,280		

JANUARY 1 TO DECEMBER 31, 1905.[a]

0.20	195	1.90	690	3.60	1,340	6.60	2,880
.30	220	2.00	725	3.70	1,385	6.80	3,000
.40	245	2.10	760	3.80	1,430	7.00	3,120
.50	270	2.20	795	3.90	1,475	7.20	3,240
.60	295	2.30	830	4.00	1,520	7.40	3,360
.70	320	2.40	865	4.20	1,620	7.60	3,480
.80	345	2.50	900	4.40	1,720	7.80	3,610
.90	375	2.60	935	4.60	1,820	8.00	3,740
1.00	405	2.70	970	4.80	1,920	8.50	4,065
1.10	435	2.80	1,010	5.00	2,020	9.00	4,410
1.20	465	2.90	1,050	5.20	2,120	9.50	4,760
1.30	495	3.00	1,090	5.40	2,220	10.00	5,110
1.40	525	3.10	1,130	5.60	2,330	11.00	5,840
1.50	555	3.20	1,170	5.80	2,440	12.00	6,590
1.60	585	3.30	1,210	6.00	2,550	13.00	7,340
1.70	620	3.40	1,250	6.20	2,660	14.00	8,090
1.80	655	3.50	1,295	6.40	2,770		

[a] Above gage height 10.4 feet the rating curve is a tangent, the difference being 75 per tenth.

Estimated monthly discharge of Oconee River near Greensboro.

[Drainage area 1,100 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
July (26–31)	924	640	716	0.651	0.145
August	7,450	605	1,481	1.35	1.56
September	5,244	420	1,051	.955	1.07
October	710	510	610	.555	.640
November	1,428	640	790	.718	.801
December	924	605	718	.653	.753
1904.					
January	1,924	640	868	.789	.910
February	4,070	780	1,576	1.43	1.54
March	3,676	960	1,464	1.33	1.53
April	1,472	780	941	.855	.954
May	1,780	420	656	.596	.687
June	1,180	360	578	.525	.586
July	1,428	360	508	.462	.533
August	6,522	540	1,348	1.23	1.42
September	1,472	280	481	.437	.488
October	390	215	278	.253	.292
November	710	330	468	.425	.474
December	1,876	510	812	.738	.851
The year	6,522	215	832	.756	10.26

Estimated monthly discharge of Oconee River near Greensboro—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.[a]					
January	4,065	555	970	0.852	1.02
February	6,965	600	2,497	2.27	2.36
March	1,170	760	937	.852	.98
April	865	585	698	.635	.70
May	3,420	555	1,156	1.05	1.21
June	1,010	435	646	.587	.65
July	5,990	405	1,195	1.09	1.26
August	2,330	220	978	.889	1.02
September	672	195	348	.316	.35
October	570	185	372	.338	.39
November	918	282	470	.427	.48
December	8,090	435	3,086	2.81	3.24
The year	8,090	185	1,113	1.01	13.67

[a] For minimum flow in 1905 see note to gage-height table.

OCONEE RIVER AT CAREY.

This station, which was established October 29, 1896, is located at an iron girder deck bridge on the Georgia Railroad at the station of Carey, 6 miles west of Greensboro, and just below the junction of the Apalachee and Oconee rivers.

Both banks are low and liable to overflow under the trestles to the end of embankments. The bed of the stream is rocky and the current good.

The top of the iron girder 20 feet from the left-bank end of the bridge on the downstream side is 41.13 feet above the datum of the gage heights.

The rating was evidently affected by the dam several miles below, and for this reason the station was abandoned March 31, 1898.

Discharge measurements of Oconee River at Carey.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1896.	*Feet.*	*Sec.-ft.*	1897.	*Feet.*	*Sec.-ft.*
October 29	1.68	644	June 9	2.50	1,869
November 17	2.08	836	July 30	1.80	1,180
November 25	1.90	795	October 4	1.08	381
1897.			November 11	1.92	675
January 18	4.90	3,318	December 14	2.30	1,117
March 18	5.15	4,257	1898.		
April 29	2.40	1,092	March 22	2.50	1,186
May 28	2.10	1,047	November 15	3.65	2,356

Daily gage height, in feet, of Oconee River at Carey.

Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
		1896.			1896.			1896.		
2.1	5.1	9	1.8	2.9	17	2.0	2.4	25	1.9	2.0
1.9	4.8	10	1.8	2.7	18		2.2	26	1.9	2.1
1.7	4.4	11	1.8	2.6	19		2.4	27	1.8	2.0
2.1	4.2	12	1.9	2.5	20		2.3	28	1.9	1.9
2.7	3.7	13	1.8	2.4	21		2.2	29	2.9	2.1
2.3	3.4	14	1.9	2.3	22		2.2	30	3.9	2.0
2.2	3.2	15	1.9	4.0	23		2.1	31		2.0
1.8	3.0	16	2.0	2.8	24		2.0			

ay.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
897.												
	2.1	2.5	3.2	3.3	4.0	2.1	1.6	1.6	1.5		2.0	2.7
	1.9	3.8	3.2	4.9	3.8	2.1	1.5	1.5	1.2	1.5	2.2	2.4
	2.1	3.7	3.1	6.1	3.3	2.1	1.1	1.5	1.2	1.4	2.4	2.2
	2.0	3.6	3.9	5.6	2.8	2.2	1.1	1.5	1.4	1.1	2.0	2.6
	2.1	3.3	3.0	14.4	2.6	2.2	1.5	1.4	1.3	1.2	1.9	2.8
	2.0	4.6	2.9	14.4	2.5	2.3	2.7	1.9	1.2	1.4	1.8	2.7
	2.1	5.0	6.4	12.4	2.3	2.2	2.6	2.4	a.8	1.3	1.8	2.5
	2.1	4.6	7.8	7.3	2.3	2.2	2.2	2.4	a.5	1.2	1.8	2.5
	1.8	3.8	6.8	5.4	2.3	2.5	1.6	2.2	a.3	1.3	1.8	2.4
	1.9	3.3	4.4	5.5	2.3	2.3	1.8	2.1	a.3	2.9	1.9	2.3
	2.0	3.1	4.0	4.5	2.2	2.2	1.8	2.0	a.2	2.8	1.7	2.3
	1.9	5.9	4.2	4.0	2.3	2.0	2.2	1.7	a.2	2.7	1.8	2.1
	2.0	6.6	7.7	3.5	2.3	1.8	1.7	1.5	a.1	2.6	1.8	2.0
	2.7	5.3	10.4	3.5	2.4	1.7	1.6	1.4	a.3	2.3	1.7	2.3
	4.3	4.4	12.2	3.3	2.3	1.7	1.1	1.2	a.4	1.9	1.7	2.5
	4.2	4.0	11.6	3.3	2.3	1.6	.7	1.1	a.7	1.9	1.7	2.4
	3.4	4.2	8.6	3.3	2.3	1.6	.7	2.9	1.5	1.8	1.8	2.3
	4.5	3.6	5.5	3.0	2.2	1.6	1.8	3.1	1.4	1.6	1.9	2.1
	4.8	3.3	4.2	2.9	2.2	1.8	3.7	3.2	1.8	1.9	1.6	2.0
	4.0	3.0	5.3	2.8	2.2	2.4	5.6	4.1	1.5	2.1	1.8	2.0
	6.0	3.8	5.5	2.7	2.0	2.1	5.6	3.0	1.4	2.1	1.8	2.2
	7.8	4.0	4.6	2.7	1.9	2.0	5.8	3.7	1.4	2.0	1.8	2.3
	6.8	3.8	4.6	2.6	2.0	1.7	5.1	2.8	1.9	2.0	1.9	2.4
	4.3	4.7	4.7	2.6	2.2	1.5	3.1	2.6	1.8	2.1	1.8	2.4
	3.3	5.3	4.2	2.7	2.1	2.2	2.4	2.1	1.8	2.0	1.8	2.4
	3.1	5.2	3.7	2.5	2.1	2.0	2.4	1.8	1.7	2.0	1.7	2.4
	2.8	4.2	3.2	2.5	2.1	1.8	2.6	1.7	1.7	1.8	2.8	2.5
	2.8	3.5	3.2	2.5	2.0	1.6	2.3	1.6	1.7	1.8	3.5	2.6
	2.6		3.0	2.5	2.1	1.5	2.3	1.4	1.7	1.6	2.7	2.3
	2.4		3.0	2.9	2.1	1.6	1.8	1.4	1.7	1.6	2.7	2.4
	2.5		3.4		2.2		1.0	1.2		1.8		2.3

y.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
8.				1898.				1898.			
	2.2	2.7	2.3	12	2.3	2.3	2.3	23	2.4	2.2	2.4
	2.1	2.5	2.2	13	2.2	2.3	2.2	24	2.4	2.2	2.4
	2.0	2.4	2.2	14	2.2	2.3	2.6	25	2.5	2.2	2.3
	2.0	2.4	2.5	15	2.1	2.3	3.5	26	5.0	2.1	2.2
	2.1	2.5	2.8	16	2.1	2.3	3.9	27	5.7	2.1	2.2
	2.1	2.4	2.7	17	2.1	2.3	3.5	28	4.5	2.1	2.3
	2.1	2.4	2.4	18	2.1	2.3	3.9	29	3.5		2.3
	2.1	2.4	2.4	19	2.0	2.3	3.1	30	3.0		2.3
	2.0	2.4	2.4	20	2.0	2.3	2.6	31	2.8		2.5
	2.1	2.4	2.3	21	2.7	2.3	2.4				
	2.2	2.4	2.3	22	2.7	2.3	2.5				

low gage heights from September 7 to 16, 1897, inclusive, were caused not by a diminution of the the stream, but by the drawing off of a dam several miles below.

Rating table for Oconee River at Carey, from October 29, 1896, to March 31, 1898.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	240	1.60	500	3.20	1,848	4.80	3,450
0.20	260	1.80	675	3.40	2,024	5.00	3,750
0.40	290	2.00	815	3.60	2,200	5.20	4,080
0.60	320	2.20	970	3.80	2,376	5.40	4,500
0.80	350	2.40	1,144	4.00	2,554	5.60	4,950
1.00	380	2.60	1,320	4.20	2,750	5.80	5,410
1.20	415	2.80	1,496	4.40	2,965	6.00	5,870
1.40	470	3.00	1,672	4.60	3,200	7.00	8,170

Estimated monthly discharge of Oconee River at Carey.

[Drainage area, 1,346 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1896.[a]					
November[b]	2,464	615	882	0.66	0.7
December	3,910	740	1,498	1.11	1.3
1897.					
January	10,000	675	2,114	1.57	1.8
February	7,250	1,232	2,905	2.16	2.3
March 1–13, 18–31	10,000	1,584	3,482	2.59	2.9
April 9–30	4,720	1,232	1,955	1.45	1.6
May	2,554	740	1,130	.84	.9
June	1,232	510	800	.59	.6
July	5,410	335	1,358	1.01	1.1
August	2,650	415	948	.70	.8
September	740	[c]250	460	.34	.3
October	1,584	395	740	.55	.6
November	2,112	560	829	.62	.6
December	1,496	815	1,116	.83	.9
1898.					
January	5,180	815	1,340	1.00	1.1
February	1,408	880	1,079	.80	.9
March	2,464	970	1,300	.97	1.1

[a] These estimates have been revised on the basis of the 1897 rating curve.
[b] Discharge interpolated November 18 to 24, 1896.
[c] The low-water height reported at Cary from September 7 to September 16, 1897, was probably caused by the opening for repairs of a dam 2 or 3 miles below this point. An inspection of the conditions at Macon and other stations shows that this period did not include the lowest water of the year but that the minimum occurred during the first two weeks in October. Leaving out of account this period of sudden apparent low water, the lowest gage reading at Cary was 1.10 on October 4. A measurement made on that day at 1.08 showed a discharge of 381 second-feet.

OCONEE RIVER AT FRALEYS FERRY, NEAR MILLEDGEVILLE.

This station is located at Fraleys Ferry, about 6 miles above Milledgeville, and about 4 miles below the mouth of Little River. This point being above the dam at Milledgeville, the river has a nearly natural flow, being but slightly affected by the dams a great distance upstream.

The channel is straight for some distance above and below the station. The current is moderate or slow at low stages. The bed is sandy and changing, but the rock shoals below will probably control the water level at the station.

Discharge measurements are made from the ferryboat or from a small boat controlled by the ferry cable along which the distances

are marked. Measurements can be made at low and medium stages only, as the current is too great for safety in boat measurements at the higher stages.

During a short period in October and November, 1905, gage-height records were maintained by Charles F. Howe, who put in a temporary gage and has furnished the records to the Geological Survey. These gage heights, which are the mean of four readings daily, and the discharge measurements which were made, form a much more accurate basis for estimating the flow for the period which they cover than the records for the station at Milledgeville, 6 miles below. The bench mark is a nail driven horizontally into an ash tree on the right bank about 200 feet above the ferry; elevation, 10.00 feet above the datum of the gage.

Discharge measurements of Oconee River at Fraleys Ferry, near Milledgeville.

Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*
June 29	4.90	1,030
September 20	4.35	547
1905.		
November 24	5.02	985

Daily gage height, in feet, of Oconee River at Fraleys Ferry, near Milledgeville.

Day.	Oct.	Nov.	Day.	Oct.	Nov.	Day.	Oct.	Nov.
1905.			1905.			1905.		
1		4.85	12		6.0	22	4.65	
2		4.85	13		5.6	23	4.55	
3		4.75	14		5.2	24	4.55	
4		4.7	15			25	4.45	
5		4.7	16			26	4.8	
6		4.6	17			27	4.8	
7		4.65	18			28	4.85	
8		4.8	19			29		
9		4.85	20	4.7		30	4.8	
10		5.0	21	4.7		31	4.85	
11		6.0						

OCONEE RIVER AT MILLEDGEVILLE.

This station was established August 22, 1903, by M. R. Hall, though several discharge measurements were made before that time, the first being made October 19, 1895, by C. C. Babb. The bench mark to which the present gage is referred was used for each of these early measurements. The station is located at the iron highway bridge in the eastern part of Milledgeville.

At low water the river is about 300 feet wide, including two piers, and often a sand bar of considerable extent in the third span. This bar sometimes practically stops the third-span channel, leaving the river about 200 feet wide. The bed is sandy and shifting and the water is shallow and swift. These conditions are unfavorable to

accurate measurements as well as a constant rating. The chann only slightly curved. Both banks are high and will not overflo

Discharge measurements are made from the downstream sid the bridge, the initial point for soundings being the end of the bridge at the right bank, downstream side. The bridge consist four spans, 100 feet, 150 feet, 150 feet, and 80 feet long, respectiv beginning at the right-bank end, and short wooden trestles abou feet long at each end.

A standard chain gage, established in August, 1904, is fastene the intermediate posts on the upstream side of the third panel of second span from the right bank. The gage is read once each by J. A. Brooks, who has been paid by the United States Weat Bureau since June 30, 1903. The bottom of the gage box is 4 feet above the datum of the gage, and the length of the chain is 4 feet. The bench mark is the top of the third floor beam from pier on the east bank, downstream end; elevation, 39.00 feet ab the datum of the gage.

Discharge measurements of Oconee River at Milledgeville.

Date.	Gage height.	Discharge.	Date.	Gage height.	D ch
1903.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Se*
August 22	3.95	2,301	June 28	1.14	
September 11	2.39	1,141	August 18	3.40	
September 12	2.27	1,042	September 19	.95	
October 16	2.39	1,140	October 11	.37	
December 16	3.05	1,908	October 11	.41	
December 18	2.74	1,720	October 12	.49	
1904.			1905.		
February 17	3.99	2,852	March 28	2.73	
February 18	3.71	2,449	June 9	1.64	
May 25	1.47	827	September 14	1.20	
May 26	1.47	857	September 15	.95	
June 10	2.04	1,213	November 23	1.16	
June 28	1.12	703			

Daily gage height, in feet, of Oconee River at Milledgeville.[a]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.
1903.						1903.				
1		2.5	2.5	2.55	2.7	17		17.3	3.5	2.8
2		2.45	2.5	2.55	2.65	18		8.6	5.7	3.4
3		2.4	2.4	2.55	2.65	19		5.3	3.6	3.2
4		2.4	2.4	2.65	2.65	20		3.9	3.0	2.9
5		2.35	2.4	3.9	2.75	21		3.4	2.9	2.85
6		2.4	2.3	3.8	2.75	22		3.2	2.75	2.85
7		2.4	2.25	3.7	2.75	23		3.1	2.65	2.85
8		2.2	3.1	3.2	2.7	24		3.0	2.6	2.85
9		3.5	2.65	3.1	2.65	25	3.2	2.9	2.55	2.8
10		2.5	2.6	2.7	3.4	26	3.1	2.85	2.45	2.8
11		2.5	2.4	2.85	3.4	27	3.0	2.6	2.4	2.75
12		2.3	2.25	2.7	3.2	28	2.85	2.6	2.5	2.7
13		2.1	2.2	2.85	2.95	29	2.75	2.6	2.5	2.7
14		2.45	2.35	2.85	3.0	30	2.65	2.5	2.5	2.7
15		3.4	2.3	2.85	3.1	31	2.55		2.55	
16		17.3	2.4	2.8	3.1					

[a] Owing to the irregular running of the mill above this station during the low-water period, the mean gage height was not always obtained, although two readings were made each day. From cause the gage heights below 0.5 foot are probably too low and in some cases gage heights above 0. may be artificially high.

Daily gage height, in feet, of Oconee River at Milledgeville—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
.....	2.9	3.4	3.9	3.2	2.5	3.55	2.4	4.6	1.8	0.6	0.6	1.3
.....	2.85	3.4	3.9	3.5	2.4	3.65	2.35	2.9	1.4	.5	.6	1.4
.....	2.8	3.2	3.8	3.2	2.35	2.65	2.1	2.8	1.4	.5	.7	2.2
.....	2.8	3.2	3.8	3.1	2.4	2.2	1.8	3.6	1.3	.9	1.1	2.0
.....	2.8	3.1	3.8	2.9	2.3	1.8	1.6	2.8	1.3	.6	1.7	2.1
.....	2.75	3.1	3.4	3.0	2.1	1.55	1.5	2.4	2.7	.5	1.8	3.2
.....	2.75	3.1	4.4	3.1	2.1	1.65	1.4	4.6	2.5	.5	1.5	4.8
.....	2.75	5.2	6.4	3.4	2.1	2.25	1.2	a 11.6	2.2	.5	1.5	4.1
.....	2.75	5.2	7.4	3.7	2.1	2.75	1.2	7.2	1.8	.4	1.4	2.9
.....	2.95	5.4	6.1	4.4	2.3	2.2	1.7	9.2	1.6	.8	1.3	2.4
.....	2.95	9.5	4.7	3.6	3.5	1.7	2.2	11.6	1.3	.4	1.1	2.2
.....	2.9	9.0	4.2	3.4	2.3	1.6	4.2	7.1	1.3	.5	1.3	2.1
.....	3.0	6.7	3.9	3.0	2.2	2.1	2.1	5.2	1.3	.5	1.5	2.2
.....	3.1	5.1	3.7	2.9	2.1	1.7	1.8	3.4	1.1	.5	1.8	2.0
.....	3.1	4.6	3.9	2.75	2.1	1.5	1.4	2.8	1.2	.3	2.0	2.0
.....	3.0	4.4	4.7	2.7	2.1	1.45	1.3	7.3	1.0	.2	1.8	2.4
.....	3.0	4.0	4.0	2.7	2.1	1.45	1.1	5.5	1.2	.7	1.6	2.2
.....	4.2	3.8	3.5	2.7	2.0	1.2	1.2	4.1	.9	.2	1.4	2.5
.....	3.5	3.6	3.5	2.75	1.95	1.2	1.0	3.3	1.0	.2	1.3	2.3
.....	3.4	3.6	3.4	2.7	1.8	1.1	1.2	2.7	.9	.3	1.2	2.0
.....	3.1	3.7	3.3	2.7	1.75	1.0	.9	2.1	1.0	.3	1.1	2.0
.....	3.2	6.9	3.3	2.65	1.75	1.4	1.0	1.9	1.0	.4	1.3	1.9
.....	11.5	9.4	3.9	2.7	1.7	2.65	.6	1.8	.7	.4	1.4	1.8
.....	8.95	8.1	6.1	2.75	1.65	2.0	1.5	1.6	.8	.4	1.5	1.7
.....	5.7	6.3	6.2	2.6	1.6	1.65	1.8	2.1	.6	.3	1.7	1.7
.....	4.5	5.1	4.6	2.5	1.45	1.4	2.4	1.9	.6	.3	1.9	1.8
.....	3.8	4.4	4.1	2.75	1.25	1.4	1.8	2.1	.6	.3	1.6	1.8
.....	3.6	4.1	4.3	2.85	1.45	1.1	1.4	2.6	.5	.6	1.3	5.4
.....	3.6	4.1	3.8	2.75	1.45	2.0	1.4	2.1	.5	.8	1.2	4.8
.....	3.6	.....	3.4	2.6	1.6	1.8	1.4	2.0	.4	.7	1.4	3.9
.....	3.4	.....	3.3	.....	2.55	.....	2.4	1.8	.....	.7	.....	3.0
1905.b												
.....	2.5	2.1	3.6	2.6	3.0	2.6	2.6	1.3	1.3	.3	.93	1.2
.....	2.4	2.1	3.5	2.4	2.8	2.3	3.3	1.4	5.4	.7	1.0	1.1
.....	2.3	2.1	3.3	2.4	4.0	2.2	6.4	1.2	4.4	.6	.92	2.3
.....	2.5	2.1	3.1	2.4	4.0	2.1	5.4	1.0	3.4	1.6	.8	8.7
.....	2.2	2.0	3.1	2.5	4.6	2.3	2.9	1.0	2.9	2.5	.77	11.4
.....	2.0	2.3	3.0	2.9	4.7	2.0	2.3	.8	1.9	1.5	.75	11.6
.....	2.4	3.0	2.9	3.1	3.7	2.0	3.0	.7	1.5	1.3	.7	5.4
.....	2.6	4.9	2.9	2.9	5.2	1.8	8.0	1.1	1.2	1.15	.8	3.4
.....	2.8	11.0	2.9	2.8	4.3	1.6	8.9	.9	1.0	.8	1.0	3.8
.....	2.6	9.7	3.3	4.5	3.6	1.5	4.2	4.4	1.0	.87	1.2	9.6
.....	2.4	8.5	3.3	4.3	3.1	1.4	3.6	5.0	1.0	.73	2.3	10.8
.....	2.6	10.3	4.5	3.7	2.8	1.4	4.5	4.0	.9	1.0	3.7	10.2
.....	3.3	21.0	6.2	5.9	2.5	1.5	4.8	6.8	.8	1.1	2.5	6.1
.....	6.3	19.2	4.5	3.9	2.2	1.6	3.6	6.5	1.2	1.3	1.9	4.1
.....	7.0	14.7	4.3	3.1	2.0	1.6	3.8	4.9	.9	1.1	1.7	6.1
.....	5.0	10.0	3.7	3.2	2.0	1.5	2.7	4.9	1.0	.98	1.5	6.2
.....	3.8	6.5	3.4	3.1	3.2	1.5	2.2	4.0	.8	1.1	1.3	5.0
.....	3.0	5.3	3.1	2.8	2.7	2.5	1.9	13.0	.8	.82	1.2	4.2
.....	2.8	4.6	3.1	2.7	2.4	2.1	1.8	5.7	.7	.93	1.0	3.5
.....	2.9	4.3	3.0	2.6	2.1	1.9	1.7	2.7	.7	.9	1.0	4.4
.....	2.9	7.8	4.2	2.4	1.9	1.7	2.1	2.1	.8	.85	1.1	18.8
.....	2.7	10.2	4.7	2.4	2.2	2.5	1.8	1.8	.6	.7	1.2	18.1
.....	2.5	9.6	3.6	2.5	3.3	4.7	1.7	1.8	.5	.63	1.1	15.1
.....	2.4	8.6	3.2	2.4	6.6	4.3	1.5	2.1	.4	.68	1.1	10.5
.....	2.4	6.3	3.1	2.3	7.2	3.2	2.1	3.4	.5	.63	1.3	6.5
.....	2.2	4.9	3.0	2.4	6.2	2.8	2.1	2.8	.5	.87	1.1	5.0
.....	2.0	4.3	3.0	2.5	4.9	2.1	1.9	3.6	.4	.87	1.1	4.3
.....	2.0	3.9	2.9	2.5	3.5	2.0	1.7	2.0	.1	1.03	1.2	3.9
.....	1.9	.....	2.7	2.3	3.1	2.2	1.5	1.6	.2	.95	1.6	6.6
.....	2.0	.....	2.6	3.1	3.0	2.7	1.2	1.4	.4	.92	1.3	6.1
.....	1.8	.....	2.6	.....	3.5	.....	1.5	1.2	.....	.88	.....	4.8

a height is doubtful.
ım October 6 to November 6, 1905, an attempt was made to obtain a proper mean gage height by
ş six readings daily. For the rest of the time only one reading was made.

Rating table for Oconee River at Milledgeville from August 25, 1903, to Decem 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	290	1.30	785	2.80	1,760	8.00	7,040
.30	330	1.40	840	3.00	1,920	9.00	8,090
.40	370	1.50	895	3.20	2,090	10.00	9,140
.50	410	1.60	950	3.40	2,265	11.00	10,190
.60	450	1.70	1,010	3.60	2,450	12.00	11,240
.70	495	1.80	1,070	3.80	2,640	13.00	12,290
.80	540	1.90	1,130	4.00	2,840	14.00	13,340
.90	585	2.00	1,190	5.00	3,890	15.00	14,390
1.00	630	2.20	1,320	6.00	4,940	16.00	15,440
1.10	680	2.40	1,460	7.00	5,990	17.00	16,490
1.20	730	2.60	1,610				

[a] Above 4-foot gage height, daily discharge estimates are based on a tangent, the differenc 105 per tenth.

Estimated monthly discharge of Oconee River at Milledgeville.[a]

Month.	Discharge in second-fe		
	Maximum.	Minimum.	M
1903.			
August 25–31	2,090	1,573	
September	16,800	1,255	
October	4,625	1,320	
November	2,740	1,573	
December	2,740	1,648	
1904.			
January	10,720	1,723	
February	8,615	2,005	
March	6,410	2,175	
April	3,260	1,535	
May	2,355	758	
June	2,498	630	
July	3,050	450	
August	10,820	950	
September	1,685	370	
October	585	[b] 290	
November	1,190	450	
December	4,310	785	
The year	10,820	290	

[a] These estimates are only approximately correct. No estimates were attempted for 1905.
[b] See note under gage heights.

OCONEE RIVER AT DUBLIN.

A station was established by the United States Weather Bureau i 1894 at Dublin, Ga., about 60 miles above the junction of the Ocone with the Ocmulgee. Records were kept, with the exception of th summer months of 1896, until April 30, 1897, when the station wa discontinued. In 1898 discharge measurements were commenced b the United States Geological Survey, and February 11 an observer wa employed to read the gage. October 15, 1898, the Weather Burea again adopted the station and has maintained the gage and furnishe gage heights to the Geological Survey continuously since that tim

The ordinary width of the river is about 235 feet. At a gage heig of about 20 feet the left bank begins to overflow, and is practica covered to the end of the approach at 25 feet. This ground is thick covered with a brushy growth, which will no doubt cause the veloc of the water overflowing it to be small. The right bank does

w. The bed of the stream is of loose rock, sand, and gravel. ıannel is straight and the current is swift and fairly uniform, where it is broken by the three bridge piers.

harge measurements are made from the iron highway bridge, consists of a draw span between two other spans of 75 feet each. tal length of the bridge proper is 320 feet. On the left bank, is low, there are 1,100 feet of iron-frame trestle approach. There a short trestle on the right bank, which is high. The initial or soundings is the end of the bridge at the right bank, on the ım side.

gage is a heavy timber bolted to the downstream side of the pier of the Wrightsville and Tennille Railroad bridge, 500 feet ream from the highway bridge.

bridge is a drawbridge, and the pier to which the gage is d is the circular center pier of the draw span. A secondary gage, reading from −1.6 to +1.9 feet, is attached to a solid ı the right bank about 25 feet above the railroad bridge. The read once each day by R. F. Mathis. Bench marks were estab- ıs follows: (1) The top of the upstream end of the floor beam of the first tubular pier of the wagon bridge from the right elevation, 41.30 feet. (2) A point on the fifth step from the at the south entrance of the court-house, 6 inches from the d of the step; elevation, 82.51 feet.

Discharge measurements of Oconee River at Dublin.

Date.	Gage height.	Discharge.
1897.	*Feet.*	*Sec.-ft.*
.....	6.10	6,400
.....	1.90	2,861
.....	1.77	2,680
.....	1.50	2,488
.....	1.43	2,488
7.	.40	1,644
1898.		
1.....	.95	2,057
.....	.65	1,927
.....	− .23	1,272
.....	− .28	1,164
.....	6.23	7,007
.....	10.80	12,160
.....	3.70	4,153
1899.		
.....	8.20	9,689
.....	8.00	9,033
.....	.80	1,937
15.....	.80	1,997
15.....	.50	1,903
4.....	3.90	4,028
1900.		
.....	4.25	4,680
.....	7.30	7,991
1901.		
1.....	5.00	5,341
.....	3.40	3,949
.....	1.00	2,334
1902.		
2.....	.27	1,651
November 12.....	0.25	1,615
November 13.....	.27	1,619
1903.		
April 3.....	15.40	20,160
April 4.....	14.95	19,800
June 6.....	8.81	9,804
June 6.....	8.51	9,432
June 15.....	4.47	5,017
July 15.....	5.95	6,579
August 24.....	4.61	4,475
October 6.....	.12	1,713
November 14.....	1.15	2,472
1904.		
February 18.....	4.33	5,136
April 12.....	2.45	3,521
July 21.....	.98	808
September 16.....	.90	840
September 17.....	.95	798
October 27.....	−1.55	515
October 27.....	−1.55	557
December 3.....	.45	1,968
1905.		
March 15.....	7.03	8,283
April 25.....	1.14	2,631
April 25.....	1.11	2,518
June 13.....	− .60	1,187
June 13	− .60	1,192
July 31.....	− .62	1,201
November 6.....	− .97	929
November 6.....	− .98	882
November 9.....	− .99	856

Daily gage height, in feet, of Oconee River at Dublin.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	I
1898.												
1			0.5	1.0	4.0	−0.6	−1.0	5.8	11.8	0.8	3.6	
2			.5	2.0	2.6	− .7	−1.1	4.3	13.0	.7	3.3	
3			.5	2.8	1.9	− .7	−1.2	2.8	16.0	2.3	3.1	
4			.9	2.0	1.7	− .8	−1.2	2.0	23.0	6.9	2.6	
5			1.9	2.5	1.4	− .9	−1.3	1.6	24.6	8.7	2.3	
6			3.9	6.0	1.1	−1.0	−1.2	2.0	23.3	9.4	2.1	
7			3.9	7.8	1.0	− .1	− .9	4.2	21.2	10.5	2.0	
8			2.6	8.5	.9	− .1	+ .3	5.9	19.5	11.3	2.0	
9			2.0	9.4	.8	−1.1	1.0	6.4	18.0	13.5	1.8	
10			1.8	10.0	.7	−1.1	1.8	6.5	17.0	15.5	1.7	
11		0.9	1.5	9.8	.6	−1.2	1.8	4.2	16.0	16.0	1.7	
12		.9	1.4	6.5	.6	−1.2	2.8	3.4	14.8	14.5	1.6	
13		.9	1.0	5.9	.3	−1.2	3.0	3.0	12.5	11.8	1.6	
14		.9	.9	3.3	.2	−1.2	1.6	4.8	7.6	5.0	3.9	
15		.9	.9	2.9	.1	− .7	2.9	5.5	4.7	3.9	6.7	
16		.8	2.0	2.5	.0	− .6	4.6	6.5	3.6	3.5	7.2	
17		.8	3.5	2.0	.0	− .4	4.0	6.4	3.0	3.2	7.6	
18		.9	3.5	1.8	− .2	.0	3.2	4.6	3.0	3.0	8.9	
19		1.0	2.8	1.7	− .2	+ .9	1.8	5.9	2.7	3.0	11.0	
20		1.5	3.1	1.5	− .3	.8	.9	6.0	2.3	2.8	13.0	
21		1.5	2.4	1.4	− .3	.6	.5	5.9	2.2	4.3	14.3	
22		1.4	1.9	1.4	− .4	.8	.0	5.0	2.0	5.6	15.0	
23		1.1	1.5	1.3	− .4	.7	− .2	3.6	2.0	6.9	14.1	
24		.9	1.1	1.8	− .4	− .3	+ .1	2.5	1.8	7.5	12.8	
25		.8	1.0	3.9	− .1	− .5	2.6	1.9	2.0	7.8	10.2	
26		.7	1.0	5.5	+ .2	− .7	5.1	1.6	2.8	6.3	8.3	
27		.5	.9	6.0	.8	− .8	6.1	1.9	2.4	4.3	6.2	
28		.5	.8	4.7	.6	− .9	7.0	7.0	1.5	3.5	5.2	
29			.7	4.9	− .1	− .9	6.7	10.5	1.2	3.1	5.0	
30			.6	5.4	− .3	− .9	6.0	10.9	.9	3.0	5.2	
31			.6		− .5		5.6	11.1		3.3		
1899.												
1	3.8	7.7	11.3	8.3	5.4	1.7	.5	2.9	2.5	−1.3	− .4	
2	3.6	8.1	13.8	8.0	4.7	1.8	.6	2.3	2.9	−1.3	− .4	
3	5.2	9.1	16.5	8.5	3.8	1.7	.4	2.0	2.7	−1.3	− .4	
4	5.8	9.9	17.0	9.0	3.7	1.5	.2	1.7	2.1	−1.3	− .5	
5	5.0	10.7	16.9	9.8	3.5	1.4	.1	1.5	1.5	− .8	− .5	
6	4.7	12.7	16.2	9.5	4.1	1.2	.0	.9	1.1	.5	− .5	
7	5.0	13.1	14.5	9.0	5.0	1.0	.2	.8	.8	2.4	− .5	
8	7.8	15.0	12.7	8.6	4.8	.8	.4	.7	.3	5.1	− .6	
9	8.6	20.1	11.0	8.0	4.4	.7	.0	.2	.2	7.2	− .6	
10	10.4	22.5	9.8	7.8	3.6	.6	− .1	− .3	.1	8.1	− .7	
11	12.2	21.7	8.6	7.5	3.0	.5	− .1	− .4	.0	8.6	− .7	
12	14.1	18.9	7.6	7.0	2.7	.4	− .2	− .2	.1	6.8	− .7	
13	14.4	17.5	7.0	6.4	2.7	.3	− .3	− .1	.7	4.1	− .8	
14	15.3	16.8	6.8	5.6	2.4	.3	− .4	− .1	1.5	1.7	− .8	
15	14.8	15.5	6.7	5.2	2.3	.9	− .4	− .2	.8	1.1	− .1	
16	14.5	13.7	7.3	5.0	2.1	1.2	− .4	− .3	.1	.6	.7	
17	14.3	12.4	7.9	4.9	2.0	.7	− .5	− .5	− .3	.5	.1	
18	13.7	12.5	8.3	4.8	1.9	.3	− .6	− .6	− .4	.3	.8	
19	13.3	12.7	9.2	5.3	1.8	.3	− .6	− .7	− .5	.5	.1	
20	13.1	13.3	10.1	5.8	1.7	.6	− .6	− .8	− .6	.4	− .2	
21	12.8	13.6	10.9	5.6	1.6	.9	− .7	− .8	− .7	.4	− .3	
22	12.6	13.0	12.6	5.5	1.5	.5	− .7	− .9	− .8	.2	− .4	
23	11.3	12.0	14.2	5.2	1.5	.3	− .7	− .7	− .9	.0	− .3	
24	8.3	10.8	13.4	5.0	1.8	.2	− .8	− .3	− .9	− .1	.1	
25	7.8	9.8	11.9	4.8	2.1	.2	− .8	− .2	−1.0	− .3	1.5	
26	7.3	9.0	10.0	5.9	1.8	.0	.3	2.5	−1.0	− .4	1.3	
27	7.1	9.7	9.6	7.4	1.7	− .1	.7	3.0	−1.1	− .5	2.1	
28	6.8	9.6	8.9	8.0	1.6	− .2	.9	3.0	−1.1	− .6	3.2	
29	7.0		8.3	7.2	1.6	− .2	1.8	5.1	−1.1	− .7	4.4	
30	7.4		8.1	6.1	1.6	.4	4.7	4.5	−1.2	− .7	3.3	
31	7.6		8.0		1.6		5.0	2.9		− .3		
1900.												
1	2.4	1.7	8.0	8.8	8.3	1.6	19.0	4.7	.8	− .1	1.0	
2	2.1	1.6	9.6	6.5	6.4	1.4	16.9	5.0	2.7	− .3	.9	
3	1.8	1.6	10.4	5.3	6.9	1.3	14.8	3.7	2.3	− .3	3.7	
4	1.7	1.6	11.0	4.8	7.3	1.2	12.7	2.9	2.1	− .2	4.7	
5	1.6	1.8	11.7	4.5	7.5	1.9	10.1	2.5	1.5	.0	5.5	

Daily gage height, in feet, of Oconee River at Dublin—Continued.

ıy.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
00.												
.....	1.6	3.4	11.0	4.3	6.7	2.8	8.5	1.9	1.2	0.8	6.5	6.4
.....	1.5	3.7	9.0	4.2	5.4	4.1	8.0	1.6	.5	1.2	6.6	7.2
.....	1.4	3.5	6.6	4.0	4.1	5.0	5.5	1.6	.4	.9	4.8	7.6
.....	1.2	3.1	5.8	3.7	3.9	6.0	3.9	1.5	.2	1.1	3.9	6.8
.....	1.4	3.5	7.0	3.5	3.3	6.2	3.2	1.3	.2	1.2	2.6	4.5
.....	1.9	7.9	8.0	3.3	3.0	6.2	2.6	.7	.0	1.0	1.8	3.3
.....	2.4	10.2	8.5	3.9	2.7	5.7	2.8	.4	— .2	.8	1.3	2.7
.....	4.3	11.9	8.7	5.0	2.5	4.3	6.6	.2	— .3	.6	1.2	2.3
.....	5.4	16.4	8.0	5.9	2.3	3.0	6.1	.1	— .1	.7	1.0	2.3
.....	5.7	22.0	7.1	6.3	2.2	2.9	5.5	.3	— .1	.6	1.0	5.2
.....	4.9	24.4	6.4	5.0	2.1	5.0	4.7	1.1	.4	.6	.9	6.7
.....	3.3	24.9	8.1	4.1	2.0	7.5	4.1	.8	4.8	.6	.8	8.1
.....	2.9	24.1	8.7	3.4	1.9	8.3	2.8	.6	5.8	.5	.7	8.4
.....	2.8	22.6	9.0	5.1	2.1	9.9	2.3	.5	6.0	.2	.9	6.4
.....	3.2	20.0	9.1	8.2	3.7	10.3	2.0	.3	3.5	.1	.7	4.2
.....	4.1	17.2	8.5	11.1	5.5	10.6	1.8	.1	1.9	.1	.7	4.6
.....	4.7	14.0	7.4	15.6	5.3	10.2	1.5	.5	1.3	.0	1.1	6.8
.....	4.4	10.7	7.8	16.9	3.6	7.9	1.2	.5	.7	.0	1.2	7.7
.....	3.9	9.1	8.3	17.6	3.1	8.0	1.0	.4	.4	.7	.8	8.0
.....	3.3	9.0	8.9	17.3	3.6	9.0	2.4	.8	.3	3.7	.8	8.2
.....	2.9	8.7	9.5	17.0	5.8	9.9	3.1	1.3	.3	5.6	.7	6.5
.....	2.4	8.1	9.6	17.1	5.0	11.6	2.1	.9	.3	5.5	1.7	4.8
.....	2.2	7.4	9.8	16.0	3.4	16.7	1.7	.7	.2	3.0	3.5	3.8
.....	2.0	.....	10.2	13.6	3.0	20.0	1.7	.5	.2	2.1	5.3	3.4
.....	1.8	.....	10.4	11.4	2.2	20.8	5.9	.5	.0	1.9	3.4	3.3
.....	1.7	.....	10.2	.....	1.9	.....	5.2	.8	.....	1.3	.....	8.4
)1.												
.....	9.8	4.7	4.6	16.4	3.7	4.0	6.1	1.5	10.3	4.0	.8	1.0
.....	10.4	6.1	4.2	16.1	3.5	6.3	6.5	1.4	10.5	4.3	.8	1.0
.....	11.3	5.6	3.9	16.5	3.3	7.0	6.0	1.2	10.3	4.5	.8	1.0
.....	12.5	6.7	3.7	16.6	3.0	7.5	5.8	1.2	9.4	5.1	.8	1.3
.....	13.0	8.6	3.4	20.5	2.9	6.0	4.3	.8	6.3	4.8	.8	1.6
.....	13.9	9.3	3.2	22.6	2.7	5.0	3.0	.5	2.4	3.9	.9	2.5
.....	13.9	11.0	3.0	21.3	2.5	5.3	2.8	1.4	2.3	2.8	1.1	2.2
.....	13.0	14.3	2.9	19.5	2.9	7.5	2.0	4.0	2.0	2.1	1.0	1.8
.....	10.8	15.6	2.8	17.4	2.8	8.1	1.8	4.4	1.7	2.0	1.0	1.6
.....	7.4	15.8	2.8	15.0	2.6	9.5	1.7	4.5	1.3	1.6	1.0	1.5
.....	6.0	14.6	4.5	12.0	2.4	8.4	2.1	2.9	1.2	1.7	.9	1.5
.....	5.4	13.8	5.5	8.2	2.1	7.5	2.1	1.7	1.0	1.7	.9	2.0
.....	6.0	13.4	6.6	6.0	2.0	4.9	2.0	3.4	.8	1.6	.9	2.0
.....	6.6	12.5	8.0	7.0	1.8	7.7	1.9	4.3	.7	2.0	.9	1.7
.....	7.4	10.2	8.2	8.0	1.8	9.1	1.8	4.0	.6	2.5	.8	2.0
.....	8.0	8.9	6.2	8.9	2.0	10.4	1.5	4.5	1.4	2.0	.9	5.5
.....	8.6	6.8	5.1	9.6	2.2	11.2	2.4	4.5	1.4	1.7	.9	6.8
.....	9.1	5.9	4.6	10.0	1.8	11.4	2.7	6.2	4.0	1.4	.9	7.4
.....	9.6	5.4	4.2	9.8	1.7	11.3	2.5	6.5	11.4	1.3	.9	8.3
.....	9.9	5.1	3.7	9.0	2.0	10.8	3.3	7.4	14.5	1.3	1.1	8.0
.....	10.3	4.7	4.7	8.1	3.6	9.7	5.9	8.0	17.8	1.2	1.4	4.5
.....	9.6	4.5	4.8	8.0	6.0	7.6	7.0	7.8	19.4	1.0	1.5	3.0
.....	6.6	4.2	4.0	7.6	7.5	5.3	7.6	7.5	18.0	1.0	1.7	2.5
.....	5.3	4.5	4.1	6.8	7.8	4.1	7.2	7.5	16.4	1.0	1.6	2.6
.....	4.6	4.9	4.3	6.2	8.1	3.7	3.5	7.3	13.8	.9	1.4	3.0
.....	4.8	4.9	4.8	5.0	6.6	4.5	2.9	7.2	8.3	.9	1.3	3.6
.....	4.7	5.0	7.5	4.6	4.5	4.1	1.5	7.8	4.0	.9	1.3	3.7
.....	5.0	5.2	9.3	4.1	4.6	6.3	1.4	8.6	3.1	.8	1.3	3.8
.....	5.1	.....	12.0	3.8	3.9	6.0	3.0	9.6	3.8	.8	1.2	6.0
.....	5.6	.....	15.1	3.8	3.1	5.5	2.3	10.0	4.1	.7	1.1	7.6
.....	5.1	.....	16.5	.....	2.8	.....	1.8	10.3	.....	.8	.....	8.6
12.												
.....	10.0	4.0	11.0	15.3	3.4	1.0	.2	2.0	.7	2.8	.8	4.0
.....	12.0	6.3	13.4	17.6	3.3	1.0	— .1	1.7	.5	1.7	.5	5.3
.....	14.1	8.0	23.0	17.5	4.5	1.2	— .2	.8	.3	2.0	.2	6.1
.....	14.9	9.5	25.5	17.1	5.5	1.8	— .2	.3	— .1	2.5	— .1	7.5
.....	15.3	14.0	25.8	16.0	4.7	1.6	— .2	2.9	— .4	1.6	— .2	8.0

Daily gage height, in feet, of Oconee River at Dublin—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.											
6	14.6	19.0	24.5	14.1	3.8	0.9	1.4	4.3	−0.6	2.9	−0.2
7	12.4	20.0	22.0	11.3	3.5	.7	.9	4.4	−.9	2.7	.3
8	7.0	19.5	19.0	9.0	3.0	.6	.7	3.5	−1.1	2.4	.6
9	4.4	18.0	16.0	9.0	3.1	2.0	.2	2.0	−1.2	1.8	.8
10	3.9	15.6	13.0	9.0	2.7	3.9	−.2	.9	−1.2	1.0	.6
11	3.6	12.3	9.0	9.0	2.7	4.0	−.7	.5	−1.3	.7	.5
12	3.2	7.3	7.5	8.5	2.7	3.0	1.0	1.0	1.2	.8	.4
13	3.0	5.0	6.5	7.0	2.5	1.3	2.5	2.4	2.0	.9	.3
14	2.8	4.3	6.0	6.0	2.3	1.0	4.5	1.3	1.5	1.0	.2
15	2.6	4.1	7.1	5.6	2.0	1.0	3.5	.7	.7	1.2	.1
16	2.5	4.1	9.8	5.5	2.2	1.2	4.4	1.0	.4	2.0	.0
17	2.4	4.8	12.7	5.5	3.0	4.5	5.1	2.3	.8	1.0	−.1
18	2.4	5.0	14.2	6.0	3.0	4.5	5.5	3.0	.6	.8	−.1
19	2.4	5.0	19.0	7.9	2.7	2.5	3.3	1.7	.2	.5	−.1
20	2.4	4.8	21.0	9.0	3.0	3.7	1.2	.8	−.2	.1	1.0
21	2.5	4.6	19.7	10.0	2.9	2.8	.8	.4	.3	−.2	2.0
22	3.1	4.5	18.0	10.0	2.8	2.0	.4	.1	.8	−.4	1.4
23	3.7	6.5	15.9	8.1	2.7	2.0	2.4	.5	.7	−.5	1.0
24	3.7	6.6	13.7	6.0	2.5	1.5	1.0	.2	.5	−.5	.7
25	3.4	7.0	11.6	5.0	2.3	1.1	.5	−.2	.2	−.6	.5
26	3.0	8.0	10.1	4.6	2.0	.7	1.7	−.4	−.1	−.6	1.0
27	2.9	8.6	9.5	4.3	1.7	.5	1.0	−.4	1.0	−.3	4.4
28	2.8	9.6	9.1	3.9	1.5	.4	1.2	−.3	3.5	1.5	5.5
29	2.6	.....	8.9	3.6	1.4	.3	2.0	.1	4.0	2.0	4.5
30	2.6	.....	10.9	3.6	1.3	.2	1.8	.2	4.2	1.8	3.5
31	3.0	.....	12.1	.....	1.1	.....	1.3	.5	.....	1.5	.....
1903.											
1	1.0	4.3	7.9	15.1	3.4	3.3	4.2	.6	.4	.5	.3
2	.9	3.8	9.0	14.9	3.1	2.8	3.2	.9	.4	.4	.3
3	2.5	3.4	10.0	15.5	3.0	4.5	2.5	1.0	.0	.3	.6
4	3.5	3.4	12.0	15.0	3.2	6.0	2.2	2.1	−.1	.1	.8
5	4.0	4.0	13.5	14.1	4.8	7.5	2.3	4.2	−.2	.0	1.9
6	5.0	5.8	13.4	12.9	6.0	8.4	1.8	4.6	−.1	−.1	3.8
7	4.5	6.6	12.4	10.9	5.5	9.3	2.8	3.3	−.2	.1	3.0
8	4.0	7.8	11.8	8.9	4.3	10.5	4.8	2.0	−.2	.3	3.0
9	3.2	8.8	11.9	8.2	4.1	11.7	5.9	1.5	−.2	.6	2.2
10	2.6	11.0	10.8	8.8	4.5	13.0	6.8	.9	−.2	.6	1.8
11	2.3	21.0	9.5	9.2	4.4	13.1	5.2	1.0	1.0	.4	1.1
12	2.8	24.0	8.8	10.0	3.9	11.2	3.5	1.0	−1.0	.2	1.0
13	3.6	23.4	8.6	10.5	3.5	8.5	3.2	1.2	.0	.1	1.1
14	4.0	22.7	8.5	10.1	3.3	6.3	4.0	1.0	.1	.1	1.1
15	4.4	12.5	8.4	9.5	5.3	4.7	5.8	1.2	.5	.0	1.1
16	3.9	20.0	8.6	9.0	8.5	3.6	6.7	2.6	2.2	.0	1.0
17	3.2	18.4	8.4	8.5	9.8	3.2	7.3	3.8	6.5	.5	1.1
18	3.2	16.9	8.3	7.3	10.8	2.7	6.8	5.4	7.6	1.2	1.0
19	3.2	15.4	7.7	6.0	11.5	2.5	3.7	6.0	9.0	4.3	1.3
20	2.8	15.6	6.8	5.3	10.4	2.3	2.5	7.0	10.7	3.0	1.6
21	2.5	16.9	6.0	5.2	5.9	2.2	2.4	8.0	9.9	1.8	1.6
22	2.4	16.8	5.9	5.4	4.2	2.4	1.7	8.8	9.0	1.6	1.6
23	2.4	15.8	7.5	5.3	3.6	2.1	1.3	9.1	2.0	.9	1.0
24	2.3	14.3	8.8	4.5	3.0	2.6	1.2	5.0	1.5	.6	1.0
25	2.4	12.0	9.8	4.1	2.7	2.4	1.0	2.5	1.3	.5	.9
26	2.7	8.2	11.3	3.8	2.4	2.0	.9	1.8	1.0	.4	.9
27	3.3	6.3	13.4	3.9	2.3	2.1	.7	1.5	.9	.3	.9
28	5.7	6.3	15.1	4.7	2.3	3.5	.6	1.0	.8	.2	.9
29	6.0	.....	17.0	4.3	2.8	3.9	.5	.9	.7	.2	.8
30	5.4	.....	17.6	3.6	5.3	4.7	.5	.6	.5	.2	.8
31	5.0	.....	16.7	.....	3.8	.....	.6	.5	.....	.3	.....
1904.											
1	1.7	2.5	3.9	2.5	1.0	.0	−.1	−.5	.6	−1.3	−1.1
1	1.7	2.8	3.5	2.0	1.0	.8	.2	.8	.1	−1.4	−1.2
3	1.7	2.7	3.5	2.0	1.0	2.0	.6	1.4	−.3	−1.3	−1.1
4	1.6	2.7	3.9	2.0	.7	1.3	.2	.9	−.4	−1.3	−1.0
5	1.6	2.7	4.0	1.8	.7	.5	−.4	1.5	−.5	−1.3	−.8
6	1.6	2.0	3.9	1.6	.7	.3	−.6	2.4	−.5	−1.3	−.5
7	1.5	2.0	3.9	1.6	.4	.1	−.7	1.6	.4	−1.3	−.3
8	1.4	3.0	4.5	2.0	.4	.1	−.7	2.4	1.1	−1.4	−.3
9	1.4	5.0	5.5	2.0	.3	.0	−.8	5.0	.6	−1.3	−.4
10	1.6	7.0	5.5	2.7	.3	−.1	−.8	6.2	.2	−1.3	−.7

Daily gage height, in feet, of Oconee River at Dublin—Continued.

ay.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
904.												
.....	1.4	8.5	6.8	3.0	0.3	−0.3	−0.9	6.5	−0.1	−1.4	−0.7	1.0
.....	1.4	9.0	5.5	3.0	.3	− .5	− .7	6.8	− .4	−1.3	− .5	.8
.....	2.0	9.9	4.0	2.0	1.0	− .1	.2	6.9	− .7	−1.4	− .5	.8
.....	2.0	9.9	3.5	2.0	1.0	− .1	.3	6.6	− .7	−1.4	− .3	.6
.....	2.0	9.9	3.4	1.4	1.0	− .1	− .4	3.5	− .7	−1.4	− .1	.5
.....	2.0	7.5	3.4	1.0	.7	− .3	− .6	1.8	− .8	−1.4	− .2	.5
.....	2.0	5.5	3.4	1.0	.7	− .5	− .8	3.8	− .9	−1.4	− .1	.8
.....	2.0	4.5	3.4	1.0	.7	− .5	− .9	3.3	− .9	−1.5	− .1	.8
.....	3.0	4.0	3.0	1.0	.7	− .5	−1.0	3.0	− .9	−1.4	− .2	.9
.....	2.8	3.5	2.9	1.0	.7	− .6	−1.0	2.0	−1.0	−1.5	− .4	.9
.....	2.6	4.0	2.5	1.0	.7	− .5	−1.0	.9	−1.0	−1.5	− .4	.8
.....	2.0	5.5	2.0	1.0	.4	− .5	−1.0	.4	−1.0	−1.5	− .5	.6
.....	2.9	7.0	2.0	1.0	.4	− .5	− .8	.1	−1.0	−1.5	− .5	.4
.....	6.6	7.8	2.9	1.0	.4	− .1	− .8	− .1	−1.1	−1.5	− .4	.3
.....	7.6	8.0	3.8	1.0	.0	− .1	− .6	.1	−1.1	−1.5	− .3	.2
.....	7.8	8.3	5.0	1.0	.0	− .4	− .3	.3	−1.1	−1.5	− .1	.2
.....	6.9	7.0	4.5	1.0	.0	− .8	− .2	.9	−1.2	−1.4	− .1	.3
.....	4.4	5.0	4.0	1.0	− .2	− .9	− .1	2.5	−1.2	−1.4	− .1	.6
.....	3.6	4.0	3.8	1.0	− .2	− .8	− .4	3.0	−1.2	−1.4	− .2	2.5
.....	3.2	.....	3.4	1.0	− .5	− .5	− .6	1.0	−1.2	−1.3	− .4	2.5
.....	2.9	.....	3.0	.....	.0	.....	− .6	1.0	.....	−1.1	.....	2.5
905.												
.....	2.1	.7	5.4	1.8	1.4	2.2	.8	− .7	− .5	−1.2	− .7	− .3
.....	1.7	.7	4.4	1.7	1.7	1.6	1.3	− .6	− .3	−1.2	− .6	− .4
.....	1.1	.7	3.9	1.7	1.9	1.2	.9	− .8	1.2	−1.3	− .6	− .2
.....	1.0	.6	3.6	1.6	2.5	.9	3.3	− .8	2.8	−1.2	− .8	.5
.....	.4	.6	3.3	1.5	3.9	.6	4.3	− .9	1.8	−1.1	− .9	4.0
.....	.4	.7	3.0	1.6	4.0	.6	2.2	−1.0	1.6	.4	− .9	5.8
.....	1.2	1.1	2.8	1.8	4.2	.6	.9	−1.1	.8	− .1	− .9	6.4
.....	1.5	1.8	2.7	2.3	3.3	.1	1.1	−1.0	.1	− .4	− .9	6.6
.....	1.5	3.8	2.5	2.1	3.3	− .1	4.4	−1.0	− .3	− .6	− .9	5.4
.....	1.6	5.9	2.8	2.1	3.3	− .3	5.5	− .8	− .5	− .6	− .8	3.4
.....	1.5	7.7	3.3	3.1	2.4	− .4	5.0	.1	− .7	− .8	− .4	5.5
.....	1.5	8.8	4.3	3.9	1.8	− .5	3.0	3.0	− .8	− .9	.0	6.4
.....	1.1	12.5	5.8	3.7	1.3	− .5	3.0	3.0	− .7	− .9	1.4	6.8
.....	1.7	14.5	7.3	5.0	.9	− .5	3.8	4.2	− .6	− .7	1.2	7.1
.....	4.2	16.8	7.3	5.3	.6	− .5	2.7	5.0	− .7	− .7	.2	7.0
.....	5.0	19.5	6.6	4.0	.3	− .1	2.3	4.0	− .6	− .6	.1	6.7
.....	4.5	19.5	5.4	3.3	.6	− .3	1.4	3.8	− .7	− .7	− .1	6.0
.....	3.3	18.0	4.4	2.9	1.2	− .3	.6	2.8	− .8	− .8	− .2	5.5
.....	2.6	16.0	3.5	2.2	1.2	− .3	.2	4.9	− .9	− .9	− .4	4.2
.....	1.6	13.8	3.0	2.0	.8	+ .3	− .1	5.8	− .9	− .9	− .5	3.0
.....	1.6	10.5	3.8	1.6	.4	− .1	− .2	3.0	−1.0	− .9	− .5	6.3
.....	1.6	8.5	4.8	1.6	.2	− .2	− .3	1.0	−1.1	− .	− .6	8.7
.....	1.6	8.8	5.2	1.6	.4	+ .2	− .2	.5	−1.1	−1.0	− .7	9.5
.....	1.4	9.4	4.3	1.4	1.9	1.4	− .3	− .1	−1.0	−1.1	− .5	11.0
.....	1.2	9.8	3.8	1.2	4.0	2.0	− .4	.1	−1.2	−1.1	− .2	13.5
.....	1.2	10.3	3.3	1.1	5.5	1.7	− .5	1.2	−1.2	−1.0	− .4	14.6
.....	.9	9.8	2.9	1.3	5.8	1.0	+ .3	1.3	−1.2	−1.0	− .4	14.0
.....	.7	7.5	2.6	1.3	4.3	.4	− .1	1.5	−1.2	− .8	− .5	12.0
.....	.6	.....	2.3	1.2	2.8	.3	− .3	.8	−1.2	− .7	− .4	8.0
.....	.6	.....	2.2	1.0	1.9	.3	− .5	.1	−1.2	− .7	− .4	7.0
.....	.7	.....	1.9	.....	1.7	.....	− .5	− .3	.....	− .7	.....	7.2

Rating tables for Oconee River at Dublin.

FEBRUARY 11, 1898, TO DECEMBER 31, 1900.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−1.30	865	0.90	2,012	3.00	3,560	7.50	8,410
−1.20	890	1.00	2,080	3.20	3,720	8.00	8,980
−1.10	920	1.10	2,149	3.40	3,890	8.50	9,550
−1.00	950	1.20	2,218	3.60	4,070	9.00	10,120
− .90	982	1.30	2,288	3.80	4,260	9.50	10,690
− .80	1,015	1.40	2,358	4.00	4,460	10.00	11,260
− .70	1,055	1.50	2,429	4.20	4,672	11.00	12,400
− .60	1,095	1.60	2,500	4.40	4,888	12.00	13,540
− .50	1,140	1.70	2,572	4.60	5,108	13.00	14,680
− .40	1,185	1.80	2,644	4.80	5,332	14.00	15,820
− .30	1,242	1.90	2,717	5.00	5,560	15.00	16,960
− .20	1,300	2.00	2,790	5.20	5,788	16.00	18,100
− .10	1,362	2.10	2,864	5.40	6,016	17.00	19,240
.00	1,425	2.20	2,938	5.60	6,244	18.00	20,380
.10	1,488	2.30	3,013	5.80	6,472	19.00	21,520
.20	1,552	2.40	3,089	6.00	6,700	20.00	22,660
.30	1,616	2.50	3,166	6.20	6,928	21.00	23,800
.40	1,681	2.60	3,243	6.40	7,156	22.00	24,940
.50	1,746	2.70	3,321	6.60	7,384	23.00	26,080
.60	1,812	2.80	3,400	6.80	7,612	24.00	27,220
.70	1,878	2.90	3,480	7.00	7,840	25.00	28,360
.80	1,945						

Estimates based on this table above gage height 12 feet are from 5 to 25 per cent too low, the percent of error increasing gradually with the increase of stage above 12 feet.

JANUARY 1 TO DECEMBER 31, 1901.[b]

0.50	2,080	1.60	2,680	2.70	3,417	3.80	4,287
.60	2,125	1.70	2,742	2.80	3,490	3.90	4,378
.70	2,173	1.80	2,805	2.90	3,564	4.00	4,472
.80	2,223	1.90	2,869	3.00	3,639	4.10	4,569
.90	2,275	2.00	2,934	3.10	3,715	4.20	4,670
1.00	2,329	2.10	3,000	3.20	3,792	4.30	4,775
1.10	2,385	2.20	3,067	3.30	3,870	4.40	4,883
1.20	2,442	2.30	3,135	3.40	3,949	4.50	4,993
1.30	2,500	2.40	3,204	3.50	4,030	4.60	5,105
1.40	2,559	2.50	3,274	3.60	4,113	4.70	5,218
1.50	2,619	2.60	3,345	3.70	4,199	4.80	5,332

JANUARY 1 TO DECEMBER 31, 1902.[c]

−1.30	900	0.00	1,475	1.20	2,210	2.80	3,410
−1.20	935	.10	1,530	1.30	2,280	3.00	3,570
−1.10	970	.20	1,585	1.40	2,350	3.20	3,740
−1.00	1,010	.30	1,640	1.50	2,420	3.40	3,910
− .90	1,050	.40	1,700	1.60	2,490	3.60	4,080
.80	1,090	.50	1,760	1.70	2,565	3.80	4,280
.70	1,135	.60	1,820	1.80	2,640	4.00	4,480
.60	1,180	.70	1,880	1.90	2,715	4.20	4,680
− .50	1,225	.80	1,945	2.00	2,790	4.40	4,900
− .40	1,270	.90	2,010	2.20	2,940	4.60	5,120
.30	1,320	1.00	2,075	2.40	3,090	4.80	5,340
.20	1,370	1.10	2,140	2.60	3,250	5.00	5,560
.10	1,420						

[a] Above gage height 5.0 feet the rating curve is a tangent, the difference being 114 per tenth.
[b] Above gage height 4.8 feet this table is the same as the 1900 table.
[c] Above gage height 5.0 feet this table is the same as the 1900 table.

Rating tables for Oconee River at Dublin—Continued.

JANUARY 1 TO DECEMBER 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−0.20	1,530	1.20	2,410	5.00	5,470	12.00	14,620
− .10	1,580	1.40	2,550	5.50	6,020	13.00	16,270
.00	1,630	1.60	2,690	6.00	6,620	14.00	17,920
.10	1,685	1.80	2,830	6.50	7,220	15.00	19,620
.20	1,740	2.00	2,970	7.00	7,820	16.00	21,320
.30	1,800	2.20	3,120	7.50	8,420	17.00	23,020
.40	1,865	2.40	3,270	8.00	9,020	18.00	24,720
.50	1,930	2.60	3,420	8.50	9,645	19.00	26,420
.60	1,995	2.80	3,570	9.00	10,270	20.00	28,120
.70	2,060	3.00	3,720	9.50	10,945	21.00	29,820
.80	2,130	3.50	4,120	10.00	11,620	22.00	31,520
.90	2,200	4.00	4,520	10.50	12,345	23.00	33,220
1.00	2,270	4.50	4,970	11.00	13,070	24.00	34,920

JANUARY 1 TO DECEMBER 31, 1904.

−1.50	560	−0.30	1,305	1.60	2,800	5.00	5,790
−1.40	600	− .20	1,381	1.80	2,964	5.50	6,300
−1.30	645	− .10	1,457	2.00	3,130	6.00	6,830
−1.20	695	.00	1,534	2.20	3,296	6.50	7,380
−1.10	750	.20	1,688	2.40	3,462	7.00	7,930
−1.00	810	.40	1,842	2.60	3,630	7.50	8,505
− .90	874	.60	1,998	2.80	3,799	8.00	9,090
− .80	941	.80	2,154	3.00	3,969	8.50	9,690
− .70	1,010	1.00	2,312	3.50	4,402	9.00	10,330
− .60	1,081	1.20	2,473	4.00	4,850	9.50	10,980
− .50	1,154	1.40	2,636	4.50	5,310	10.00	11,630
− .40	1,229						

JANUARY 1 TO DECEMBER 31, 1905.[b]

−1.30	690	0.90	2,360	3.00	4,150	6.20	7,310
−1.20	750	1.00	2,440	3.10	4,240	6.40	7,530
−1.10	810	1.10	2,520	3.20	4,330	6.60	7,750
−1.00	875	1.20	2,605	3.30	4,420	6.80	7,970
− .90	945	1.30	2,690	3.40	4,510	7.00	8,190
− .80	1,015	1.40	2,775	3.50	4,600	7.50	8,790
− .70	1,090	1.50	2,860	3.60	4,695	8.00	9,390
− .60	1,165	1.60	2,945	3.70	4,790	8.50	9,990
− .50	1,240	1.70	3,030	3.80	4,885	9.00	10,640
− .40	1,320	1.80	3,115	3.90	4,980	9.50	11,290
− .30	1,400	1.90	3,200	4.00	5,075	10.00	11,990
− .20	1,480	2.00	3,285	4.20	5,265	11.00	13,430
− .10	1,560	2.10	3,370	4.40	5,455	12.00	14,930
.00	1,640	2.20	3,455	4.60	5,650	13.00	16,500
.10	1,720	2.30	3,540	4.80	5,850	14.00	18,100
.20	1,800	2.40	3,625	5.00	6,050	15.00	19,800
.30	1,880	2.50	3,710	5.20	6,250	16.00	21,500
.40	1,960	2.60	3,795	5.40	6,450	17.00	23,200
.50	2,040	2.70	3,880	5.60	6,650	18.00	24,900
.60	2,120	2.80	3,970	5.80	6,870	19.00	26,600
.70	2,200	2.90	4,060	6.00	7,090	20.00	28,300
.80	2,280						

[a] The table becomes tangent above 14 feet, with a difference of 170 per tenth.
[b] Above gage height 14 feet the rating curve is a tangent, the difference being 170 per tenth.

Estimated monthly discharge of Oconee River at Dublin.

[Drainage area, 4,182 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1898.[a]					
February 11–28	2,429	1,746	2,040	0.49	0.32
March	4,360	1,746	2,582	.62	.71
April	11,260	2,080	5,011	1.20	1.34
May	4,460	1,140	1,794	.43	.49
June	2,012	890	1,201	.29	.32
July	7,840	865	3,104	.74	.85
August	12,514	2,500	5,697	1.36	1.57
September	27,904	2,012	10,648	2.55	2.84
October	18,100	1,878	7,449	1.78	2.05
November	16,900	2,500	7,097	1.70	1.90
December	14,224	4,360	7,338	1.75	2.02
1899.[a]					
January	17,302	4,070	10,736	2.57	2.96
February	25,510	8,638	14,954	3.58	3.73
March	19,240	7,498	12,183	2.91	3.35
April	11,032	5,332	7,639	1.83	2.04
May	6,016	2,429	3,420	.82	.94
June	2,644	1,300	1,862	.45	.50
July	5,500	1,015	1,669	.40	.46
August	5,674	982	2,097	.50	.58
September	3,480	890	1,630	.39	.44
October	9,064	865	2,628	.63	.72
November	4,888	1,015	1,666	.40	.45
December	6,244	1,746	3,047	.73	.84
The year	25,510	865	5,294	1.27	17.02
1900.[a]					
January	6,358	2,218	3,506	.84	.97
February	28,246	2,500	12,002	2.87	2.99
March	13,198	6,472	9,874	2.36	2.73
April	19,924	3,805	9,512	2.27	2.53
May	9,322	2,717	4,754	1.14	1.31
June	23,572	2,218	8,371	2.00	2.23
July	21,520	2,080	6,396	1.53	1.76
August	5,560	1,488	2,314	.55	.63
September	6,700	1,242	2,371	.57	.64
October	6,244	1,242	2,233	.53	.61
November	7,384	1,878	3,220	.77	.86
December	9,436	2,500	5,846	1.40	1.61
The year	28,246	1,242	5,867	1.40	18.97
1901.[a]					
January	15,706	5,105	9,396	2.25	2.60
February	17,872	4,670	9,315	2.23	2.32
March	18,670	3,490	6,494	1.55	1.79
April	25,624	4,287	12,344	2.95	3.29
May	9,094	2,742	4,250	1.02	1.18
June	12,856	4,199	8,065	1.93	2.15
July	8,524	2,559	4,258	1.02	1.18
August	11,602	2,080	5,999	1.43	1.65
September	21,976	2,125	8,035	1.92	2.14
October	5,674	2,173	3,046	.73	.84
November	2,742	2,223	2,369	.56	.62
December	9,664	2,329	4,435	1.06	1.22
The year	25,624	2,080	6,500	1.55	20.98

[a] Daily estimates of discharge above gage height 12 feet for the years 1898 to 1902, inclusive, are from 5 to 25 per cent too low, owing to insufficient data to properly determine the upper part of the original rating curve. The error gradually increases with the increase of stage above 12 feet. The estimates for these years were not revised because the number of days when the gage height was more than 12 feet was relatively small and hence the monthly estimates are but slightly affected.

Estimated monthly discharge of Oconee River at Dublin—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1902.a					
	17,302	3,090	6,315	1.51	1.74
	22,660	4,480	9,813	2.35	2.45
	29,272	6,700	16,243	3.88	4.47
	19,924	4,090	9,942	2.38	2.66
	6,130	2,140	3,436	.82	.95
	5,010	1,585	2,685	.64	.71
	6,130	1,135	2,567	.61	.70
	4,900	1,270	2,318	.54	.62
	4,690	900	1,904	.46	.51
	3,490	1,180	2,203	.53	.61
	6,130	1,370	2,189	.52	.58
	11,032	2,075	5,134	1.23	1.42
year	29,272	900	5,409	1.29	17.48
1903.					
	6,620	2,200	4,090	.98	1.13
	34,920	4,040	16,766	4.01	4.18
	24,040	6,500	12,704	3.04	3.50
	20,470	4,200	10,120	2.42	2.70
	13,845	3,195	5,701	1.36	1.57
	16,435	2,970	6,537	1.56	1.74
	8,180	1,930	4,016	.96	1.11
	10,405	1,930	3,964	.95	1.10
	12,635	1,530	3,563	.85	.95
	4,790	1,580	2,044	.49	.56
	4,360	1,800	2,501	.60	.67
	4,280	1,995	2,634	.63	.73
year	34,920	1,530	6,220	1.49	19.94
1904.					
	8,850	2,636	3,897	.932	1.07
	11,500	3,130	6,599	1.58	1.70
	7,710	3,130	4,717	1.13	1.30
	3,969	2,312	2,766	.661	.738
	2,312	1,154	1,899	.454	.523
	3,130	874	1,449	.346	.386
	1,998	810	1,169	.280	.323
	7,820	1,154	3,617	.865	.997
	2,392	695	1,131	.270	.301
	750	560	609	.146	.168
	1,611	695	1,205	.288	.321
	3,969	1,154	2,329	.567	.642
year	11,500	560	2,616	.626	8.47
1905.					
	6,050	1,960	3,021	.722	.832
	27,450	2,120	11,260	2.69	2.80
	8,550	3,200	5,082	1.22	1.41
	6,350	2,440	3,506	.838	.935
	6,870	1,800	3,538	.846	.975
	3,455	1,240	1,947	.466	.520
	6,550	1,240	2,839	.679	.783
	6,055	810	2,685	.642	.740
	3,970	750	1,346	.322	.359
	1,960	690	1,019	.244	.281
	2,775	945	1,346	.322	.359
	19,120	1,320	8,121	1.94	2.24
year	27,450	690	3,810	.911	12.23

estimates of discharge above gage height 12 feet for the years 1898 to 1902, inclusive, are from cent too low, owing to insufficient data to properly determine the upper part of the original ve. The error gradually increases with the increase of stage above 12 feet. The estimates ears were not revised because the number of days when the gage height was more than 12 feet vely small and hence the monthly estimates are but slightly affected.

APALACHEE RIVER NEAR BUCKHEAD.

This station was established February 13, 1901, by M. R. Hall. I is located at the iron wagon bridge over Apalachee River, about 3; miles north of Buckhead.

At ordinary stages the channel is about 80 feet wide, and is only slightly curved above and below the bridge. The bed of the stream is part rock and part sand. The current is moderately swift and is somewhat broken and irregular on account of the ruins of old pier bases about 50 feet upstream. The right bank is low for a distance of 400 feet and will overflow at a gage height of 10 feet. The low portion is thickly covered with trees and a brushy growth, which will greatly retard the flood water passing over it. The left bank is high and will not overflow, except to a short distance up the steep slope.

Discharge measurements are made from the downstream side of the bridge, the initial point being the outside of the iron pier at the left bank, downstream side. The bridge is a single span 103 feet long, supported by tubular piers. Its trestle approaches are about 500 feet long on the right bank and about 100 feet on the left.

The original gage consisted of two sections. The first section, reading from 0 to 10 feet, was fastened to a small ash tree on the left bank about 100 feet below the bridge, and the second, reading from 6 to 20 feet, was nailed to the upstream post of the last wooden bent next to the iron bridge, on the right bank. March 22, 1905, a standard chain gage was attached to the upstream side of the bridge, in the third panel from the right bank; length of the chain, 30.70 feet. The gage is read once each day by G. A. J. Adams, except for three months during low water, when readings are made twice each day. Bench marks were established as follows: (1) The top of the downstream end of the first floor beam from the right bank; elevation, 25.50 feet above datum of gage. (2) A copper plug set in solid rock 10 feet west of the upstream tubular pier on the right bank and 3 feet upstream from the line of the upper edge of the bridge; elevation, 3.73 feet above datum of gage.

Discharge measurements of Apalachee River near Buckhead.

Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*
ıary 13	3.78	847
ıary 19	3.00	647
h 29	4.62	1,033
22	6.45	1,658
st 9	2.56	545
mber 1	1.80	302
1902.		
ıary 8	3.95	821
7	1.52	262
19	1.50	253
1902.		
ıry 15	2.33	444
27	1.88	361
12	3.07	643
25	1.51	266
st 28	1.31	214
ber 9	1.45	237
mber 1	1.60	255
1904.		
March 19	2.39	466
May 12	1.83	311
July 13	1.48	223
August 9	7.15	1,877
August 9	7.30	1,903
September 21	.90	128
October 13	.80	91
October 13	.80	94
November 26	1.39	186
November 26	1.34	167
1905.		
March 23	2.30	379
May 11	1.74	273
June 8	1.44	223
June 8	1.41	208
September 8	1.13	157
September 8	1.13	157
October 30	.80	97
October 31	1.38	185
November 15	1.39	183

Daily gage height, in feet, of Apalachee River near Buckhead.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
			2.6	4.9	2.7	6.1	3.5	2.0	3.5	2.2	1.7	1.9
			2.6	5.3	2.6	3.6	3.0	1.9	3.0	2.2	1.7	2.0
			2.6	14.0	2.6	3.1	2.7	1.8	2.8	2.4	1.7	2.0
			2.6	13.8	2.5	3.0	2.6	1.9	2.6	2.5	1.75	2.5
			2.5	7.5	2.5	2.9	2.5	1.8	2.4	2.6	1.9	2.4
			2.5	5.3	2.6	2.8	2.4	1.8	2.2	2.4	1.9	2.2
			2.4	4.5	2.5	8.5	2.1	2.0	2.1	2.2	1.8	2.1
			2.4	4.0	2.4	8.5	2.0	6.5	2.1	2.2	1.8	2.0
			2.4	3.6	2.4	3.5	2.9	2.7	2.0	2.1	1.8	2.2
			2.5	3.4	2.3	3.1	2.5	2.5	2.0	2.1	1.8	3.0
			4.5	3.2	9.3	2.9	2.4	4.0	1.9	2.0	1.8	2.8
			5.7	3.1	2.2	2.8	2.3	6.0	1.9	1.9	1.8	2.2
		3.78	3.5	3.1	2.6	2.7	2.1	3.5	1.8	1.9	1.8	2.2
			3.0	7.0	2.4	4.0	2.0	3.1	1.8	1.85	1.85	2.1
			2.7	6.7	2.3	4.5	1.9	3.0	1.8	1.85	1.85	8.0
			2.6	5.5	2.2	4.5	3.0	5.0	1.9	1.8	1.8	7.0
			2.5	4.1	2.2	6.0	2.7	10.5	4.0	1.8	1.8	6.0
			2.5	3.7	2.1	4.5	2.5	5.7	10.5	1.8	1.8	4.5
		3.0	2.4	3.9	2.4	4.0	4.0	4.5	12.5	1.8	1.9	4.1
			2.4	5.0	2.8	3.8	6.0	4.0	7.0	1.8	2.1	4.0
			2.7	4.3	4.4	3.5	6.0	4.0	5.0	1.8	2.1	3.8
			2.6	3.5	6.8	3.2	3.0	4.5	3.2	1.8	2.2	3.6
			2.5	3.3	3.5	3.5	2.5	4.0	3.0	1.8	2.2	3.6
			2.9	3.2	3.0	2.8	2.2	3.5	2.8	1.75	2.0	4.2
			3.0	3.1	2.6	2.5	2.1	4.0	2.7	1.75	1.9	3.9
			7.5	3.0	2.4	5.0	2.6	3.8	2.6	1.75	1.9	3.6
			11.5	2.9	2.3	4.0	2.9	3.6	2.4	1.75	1.9	3.6
			8.0	2.9	2.3	2.9	3.0	4.5	2.2	1.75	1.9	4.5
			7.0	2.8	2.2	3.8	3.0	7.0	2.4	1.75	1.9	6.5
			6.0	2.7	2.2	4.0	2.5	5.5	2.2	1.75	1.9	13.0
			6.3		3.5		2.2	3.8		1.7		15.5
1902.												
	11.0	6.2	25.0	8.0	2.6	1.75	1.6	1.8	1.6	2.5	1.5	2.8
	7.0	17.5	20.0	5.5	2.8	1.75	1.6	1.6	1.5	2.0	1.5	3.1
	5.5	20.0	15.0	4.5	2.7	1.75	2.1	4.0	1.5	1.9	1.5	3.5
	4.5	15.0	10.0	4.0	2.7	1.7	2.0	4.5	1.5	1.8	1.6	5.0
	4.2	11.0	7.0	3.8	2.6	1.7	1.8	4.0	1.4	1.8	1.6	4.5
	4.1	8.0	6.0	3.7	2.6	1.7	1.7	3.0	1.4	1.8	1.6	3.5
	4.0	6.0	5.0	4.5	2.5	1.7	1.6	2.7	1.6	1.8	1.5	3.2
	3.8	4.0	4.0	4.0	2.4	4.0	1.55	2.5	1.8	1.7	1.5	3.1
	3.7	3.9	3.5	3.8	2.4	5.5	1.5	2.2	1.7	1.7	1.5	3.0
	3.5	3.8	3.5	3.6	2.3	4.0	1.5	2.0	1.7	1.7	1.5	3.0

Daily gage height, in feet, of Apalachee River near Buckhead—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	De
1902.												
11	3.4	3.8	3.3	3.5	2.3	3.0	1.6	1.9	1.9	1.7	1.45	2.
12	3.2	3.8	3.3	3.5	2.3	2.7	2.0	1.85	2.0	1.7	1.45	2.
13	3.1	3.7	3.8	3.5	2.3	2.4	1.9	1.8	2.5	1.7	1.45	2.
14	3.0	3.7	4.5	3.4	2.4	2.1	6.0	1.75	4.0	1.7	1.45	2.
15	2.9	3.7	5.0	3.4	2.4	2.0	3.0	1.7	3.8	1.7	1.4	1.
16	2.9	3.7	6.5	3.3	2.4	4.5	2.5	1.7	3.4	1.6	1.4	1.
17	2.8	3.8	10.0	3.3	2.3	3.8	2.3	1.6	3.0	1.6	1.5	1.
18	2.8	3.9	7.5	4.5	2.3	2.8	2.1	1.6	2.8	1.6	1.7	1.
19	2.8	3.9	6.0	4.3	2.3	2.5	2.0	1.5	2.8	1.6	1.6	1.
20	2.8	3.8	5.5	4.0	2.2	2.2	1.9	1.5	3.2	1.6	1.6	1.
21	2.7	3.7	5.2	3.8	2.2	2.0	1.8	1.5	3.0	1.55	1.6	2.
22	2.7	3.7	5.0	3.6	2.1	1.9	1.75	1.4	2.8	1.55	1.6	1.
23	2.6	3.8	4.8	3.4	2.1	1.9	1.7	1.4	2.7	1.5	1.6	1.
24	2.6	3.9	4.7	3.2	2.0	1.8	1.65	1.2	2.7	1.5	2.0	2.
25	2.8	4.0	4.5	3.0	1.9	1.8	1.6	1.1	3.0	1.5	2.1	2.
26	3.0	5.0	4.3	2.7	1.9	1.75	1.5	1.0	3.0	1.5	2.0	2.
27	3.2	16.0	3.8	2.8	1.85	1.7	1.6	1.2	2.8	1.8	2.0	2.
28	3.6	20.0	4.4	2.7	1.8	1.7	2.1	1.3	2.8	1.8	1.9	2.
29	3.7	.....	4.5	2.7	1.8	1.65	2.6	1.5	2.7	1.7	2.1	2.
30	4.0	.....	7.0	2.7	1.75	1.65	2.1	1.6	3.5	1.7	2.6	2.
31	4.5	.....	12.0	.....	1.75	.....	1.9	1.6	.....	1.6	.....	1.
1903.												
1	2.8	2.5	7.8	8.8	2.7	4.0	2.2	1.2	1.1	1.7	1.2	1.
2	2.6	3.1	7.0	5.7	2.6	10.0	2.0	3.4	.9	1.7	1.2	1.
3	2.5	3.4	6.0	5.0	2.7	8.5	2.1	5.1	1.6	1.7	1.9	1.
4	2.8	4.2	4.5	4.5	3.1	4.4	2.2	4.7	1.5	1.7	2.9	1.
5	2.6	4.5	4.2	4.4	3.4	5.5	2.0	2.9	1.5	1.8	2.7	1.
6	2.7	5.5	4.0	4.2	2.8	9.0	2.4	3.1	1.4	1.1	2.4	1.
7	2.6	5.9	4.0	4.1	2.7	9.2	2.0	2.1	.9	1.8	2.4	1.
8	2.4	17.0	4.0	5.0	2.6	4.5	6.2	1.9	.9	1.7	2.0	1.
9	2.4	15.0	3.8	9.5	2.7	3.3	4.2	1.8	1.2	1.7	1.4	2.
10	2.0	11.0	5.5	7.0	2.6	3.2	2.3	1.6	1.5	1.7	2.0	2.
11	2.0	10.0	7.0	4.9	2.5	4.0	2.7	1.7	1.4	1.5	2.0	2.
12	3.0	13.0	5.0	4.2	2.4	3.7	2.5	1.6	1.3	1.4	1.9	2.
13	2.9	9.0	4.4	3.8	2.4	3.5	4.2	1.9	1.2	1.7	1.8	2.
14	2.6	7.1	4.0	6.0	2.7	2.7	8.5	1.9	1.3	1.7	1.9	1.
15	2.4	5.2	3.9	4.9	3.2	2.5	10.0	2.4	1.9	1.7	1.9	1.
16	2.3	4.5	3.8	4.5	4.6	2.3	3.8	3.3	7.5	1.9	1.8	1.
17	2.3	7.2	3.6	3.9	4.0	2.1	2.7	3.5	8.5	1.8	1.9	1.
18	2.2	6.5	3.4	3.5	2.8	2.1	2.7	7.0	4.3	2.1	2.0	1.
19	2.2	5.2	3.2	3.0	2.5	2.0	2.3	3.7	2.5	1.8	2.0	1.
20	2.15	4.5	3.0	3.1	2.4	2.0	2.1	2.3	2.1	1.9	1.9	1.
21	2.4	4.0	3.1	3.5	2.3	2.6	2.1	2.2	1.9	1.8	1.9	1.
22	2.3	4.0	7.0	3.2	2.2	2.7	2.0	2.1	1.8	1.8	2.0	1.
23	2.3	3.6	10.0	3.0	2.2	2.2	1.9	1.8	1.7	1.7	1.5	1.
24	2.2	3.2	15.0	2.9	2.2	2.0	1.8	1.7	1.6	1.7	1.9	1.
25	2.2	2.9	13.2	2.8	2.1	1.9	1.8	1.9	1.8	1.5	1.9	1.
26	2.1	3.0	7.0	3.5	2.0	2.0	1.7	1.9	1.9	1.8	2.0	1.
27	2.0	3.1	4.9	3.4	1.9	2.8	1.6	1.7	1.8	1.8	2.0	1.
28	3.0	6.2	4.1	3.0	1.8	2.8	1.5	1.6	1.5	1.7	2.0	1.
29	2.8	.....	4.5	2.8	1.9	3.0	1.4	1.3	1.6	1.5	1.5	1.
30	2.5	.....	8.0	2.7	2.0	3.4	1.4	1.5	1.7	1.4	1.9	1.
31	2.4	.....	11.0	.....	2.0	.....	1.3	1.4	.....	1.3	.....	1.
1904.												
1	1.8	1.9	2.4	2.2	1.9	2.3	2.0	1.7	1.5	.65	.95	1.
2	1.8	1.8	2.5	2.4	1.5	2.1	1.8	1.9	1.5	.65	1.25	1.
3	1.9	1.8	2.5	2.2	1.8	1.5	1.3	2.1	1.4	a.5	1.2	1.
4	1.8	1.9	2.4	2.1	1.9	1.3	1.4	3.0	1.6	.65	1.9	1.
5	1.7	2.0	2.3	2.0	1.6	1.5	1.3	2.7	2.8	.65	1.85	2.
6	1.7	2.1	2.4	2.0	1.7	1.4	1.2	2.4	2.3	.65	1.5	2.
7	1.6	2.1	3.6	2.2	1.8	1.3	1.1	3.0	1.9	.75	a1.0	1.
8	1.6	3.1	5.7	2.8	1.9	2.9	1.0	4.5	1.7	.8	1.45	2.
9	1.5	4.0	4.8	4.0	2.0	2.4	3.0	5.7	1.6	.65	1.4	2.
10	1.8	4.5	3.4	2.9	2.5	1.9	1.9	9.9	1.4	a.45	1.25	1.

a During low water in September, October, and November the Monday gage heights are lower than natural flow on account of storing water during Sunday at High Shoals Factory, 25 miles above this station.

Daily gage height, in feet, of Apalachee River near Buckhead—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
.....	1.9	7.0	3.0	2.4	2.1	1.6	1.8	6.7	1.3	0.65	1.35	1.8
.....	1.9	6.5	2.8	2.3	2.0	1.6	1.7	6.4	1.3	.65	1.35	1.8
.....	2.0	5.5	2.5	2.3	1.8	1.5	1.6	2.5	1.4	.6	1.9	1.75
.....	2.0	3.1	2.3	2.2	1.7	1.5	1.5	2.6	1.4	.6	1.8	1.7
.....	2.0	3.0	3.5	2.1	1.9	1.4	1.4	2.8	1.3	.65	1.85	1.7
.....	2.0	2.8	3.3	2.0	1.8	1.4	1.2	3.5	1.2	.65	1.75	1.8
.....	2.2	2.4	2.8	1.9	1.8	1.3	1.0	4.5	1.0	a.45	1.7	1.8
.....	2.1	2.2	2.6	2.0	1.8	1.3	.8	2.6	.85	.55	1.7	2.0
.....	2.1	2.5	2.4	2.1	1.7	1.0	1.0	2.8	a.65	.65	1.65	1.8
.....	2.0	3.3	2.3	2.2	1.7	.7	1.2	2.0	.8	.65	1.45	1.9
.....	2.1	4.0	2.2	2.3	1.6	2.0	1.0	1.7	.8	.65	a1.0	1.8
.....	2.2	5.1	3.0	2.2	1.5	1.7	1.6	1.5	.8	.65	1.45	1.7
.....	6.0	6.8	3.2	2.1	1.5	1.5	1.6	2.0	.75	.6	1.75	1.7
.....	6.5	5.0	3.1	2.0	1.4	1.4	2.0	2.1	.75	a.4	1.65	1.6
.....	2.7	3.5	2.9	1.9	1.4	1.3	1.2	2.3	.75	.7	1.7	1.5
.....	2.5	3.0	2.7	2.1	1.4	1.3	1.6	2.0	a.55	.85	1.5	1.6
.....	2.4	2.8	3.0	2.2	1.3	1.2	1.5	1.7	.6	1.4	1.45	1.6
.....	2.4	2.6	2.7	2.3	1.3	1.2	1.5	2.0	1.05	1.05	a1.25	3.0
.....	2.3	2.5	2.5	2.2	1.3	1.6	1.6	1.7	.9	.9	1.5	3.2
.....	2.0	.....	2.4	2.1	1.2	2.5	1.6	1.6	.75	.95	1.45	2.5
.....	2.0	.....	2.3	.....	1.8	.....	1.5	1.6	.....	a.65	.....	2.2
1905.												
.....	2.0	1.8	2.8	2.0	2.4	2.0	2.8	1.5	1.05	0.86	1.3	1.4
.....	1.8	1.9	2.7	1.9	2.1	1.8	6.4	1.4	2.7	a.52	1.15	1.55
.....	2.2	1.9	2.6	1.8	2.2	1.95	9.0	1.35	3.1	.62	1.1	4.6
.....	2.0	1.8	2.5	2.0	3.5	2.1	3.3	1.3	2.1	1.05	1.1	13.7
.....	1.9	1.9	2.5	2.2	3.3	1.65	2.0	1.25	1.72	1.45	1.1	10.5
.....	1.8	2.0	2.4	2.2	3.4	1.85	2.3	1.0	1.4	1.3	a.71	5.5
.....	2.2	2.5	2.4	2.25	2.4	1.65	5.4	a.4	1.15	1.15	1.35	2.95
.....	2.1	3.4	2.3	2.25	2.5	1.55	10.2	1.0	1.1	1.1	1.3	3.2
.....	2.1	4.5	2.5	2.25	2.25	1.5	5.5	1.95	1.0	a.51	1.25	6.4
.....	2.0	5.6	2.5	2.25	2.2	1.45	3.0	4.3	.92	1.25	1.4	9.7
.....	2.0	6.2	2.4	2.3	2.2	1.35	2.65	4.4	a.65	1.3	2.6	9.0
.....	2.1	7.8	2.6	2.25	1.9	.85	2.7	4.4	.91	1.3	2.3	5.0
.....	4.7	9.0	2.7	2.25	1.8	1.35	2.75	5.3	.94	1.25	1.95	4.2
.....	5.0	11.4	3.1	2.2	1.7	1.4	2.6	3.6	.88	1.25	1.6	3.6
.....	4.2	9.0	2.8	2.2	1.5	1.35	2.35	4.7	.95	1.2	1.55	3.6
.....	3.0	5.3	2.7	2.2	2.1	1.35	1.9	3.4	.92	a.68	1.45	4.7
.....	2.6	4.2	2.5	1.9	2.2	2.05	1.5	2.7	.88	1.2	1.45	3.8
.....	2.2	3.7	2.4	2.2	2.0	1.5	1.75	7.6	a.52	1.15	1.45	3.0
.....	2.3	3.3	2.2	2.0	1.8	1.0	1.7	2.7	.85	1.15	1.35	2.7
.....	2.3	3.3	1.9	2.0	1.7	1.5	3.6	2.3	.73	1.1	1.0	4.2
.....	2.2	5.6	2.4	1.9	1.5	1.35	1.95	1.65	.66	1.1	1.5	11.0
.....	2.1	7.3	2.5	2.0	1.2	3.8	1.7	1.9	.75	.92	1.4	14.0
.....	2.0	6.0	2.4	1.9	2.1	4.6	1.7	1.8	.82	a.59	1.4	9.9
.....	1.9	4.8	2.35	1.8	3.3	3.4	1.0	1.7	.78	1.15	1.35	5.7
.....	1.9	3.4	2.3	1.9	4.7	3.3	2.15	1.6	a.41	1.1	1.3	4.2
.....	1.8	3.2	2.25	2.0	4.7	2.2	2.1	1.55	.63	1.15	1.3	3.7
.....	1.8	3.0	2.2	1.9	3.1	1.85	1.75	1.4	.6	1.15	1.35	3.4
.....	1.9	2.9	2.2	1.9	2.5	3.1	1.6	a.78	.67	1.1	1.65	3.8
.....	1.9	.....	2.2	1.8	2.9	2.35	1.5	1.2	.65	1.1	1.55	4.2
.....	1.8	.....	2.2	1.7	3.1	1.95	1.4	1.1	.65	a.85	1.4	4.0
.....	1.8	.....	2.0	.....	2.2	.....	1.65	1.0	.....	1.35	.....	4.0

uring low water the Monday gage heights are lower than natural flow on account of storing water ndays at High Shoals Factory, 25 miles above the station.

Rating tables for Apalachee River near Buckhead.

MARCH 1 TO DECEMBER 31, 1901.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	280	3.70	827	5.70	1,377	9.40	2,395
1.80	305	3.80	855	5.80	1,405	9.60	2,450
1.90	333	3.90	882	5.90	1,432	9.80	2,505
2.00	360	4.00	910	6.00	1,460	10.00	2,560
2.10	388	4.10	937	6.20	1,515	10.50	2,697
2.20	415	4.20	965	6.40	1,570	11.00	2,835
2.30	442	4.30	992	6.60	1,625	12.00	3,110
2.40	470	4.40	1,020	6.80	1,680	13.00	3,385
2.50	497	4.50	1,047	7.00	1,735	14.00	3,660
2.60	525	4.60	1,075	7.20	1,790	15.00	3,935
2.70	552	4.70	1,102	7.40	1,845	16.00	4,210
2.80	580	4.80	1,130	7.60	1,900	17.00	4,485
2.90	607	4.90	1,157	7.80	1,955	18.00	4,760
3.00	635	5.00	1,185	8.00	2,010	19.00	5,035
3.10	662	5.10	1,212	8.20	2,065	20.00	5,310
3.20	690	5.20	1,240	8.40	2,120	21.00	5,585
3.30	717	5.30	1,267	8.60	2,175	22.00	5,860
3.40	745	5.40	1,295	8.80	2,230	23.00	6,135
3.50	772	5.50	1,322	9.00	2,285	24.00	6,410
3.60	800	5.60	1,350	9.20	2,340	25.00	6,685

JANUARY 1 TO DECEMBER 31, 1902.[a]

1.00	205	1.40	241	1.80	310		
1.20	219	1.60	271	2.00	360		

JANUARY 1 TO DECEMBER 31, 1903.[b]

0.90	170	1.20	203	1.50	248	1.80	310
1.00	180	1.30	216	1.60	267		
1.10	191	1.40	231	1.70	288		

JANUARY 1 TO DECEMBER 31, 1904.[c]

0.40	43	1.40	216	2.60	514	4.40	1,025
.50	55	1.50	238	2.80	568	4.60	1,085
.60	69	1.60	261	3.00	622	4.80	1,145
.70	84	1.70	284	3.20	678	5.00	1,205
.80	100	1.80	308	3.40	734	6.00	1,505
.90	117	1.90	333	3.60	791	7.00	1,805
1.00	135	2.00	358	3.80	849	8.00	2,105
1.10	154	2.20	409	4.00	907	9.00	2,405
1.20	174	2.40	461	4.20	965	10.00	2,705
1.30	195						

JANUARY 1 TO DECEMBER 31, 1905.[d]

0.40	44	2.10	358	3.70	820	6.60	1,690
.50	54	2.20	384	3.80	850	6.80	1,750
.60	66	2.30	410	3.90	880	7.00	1,810
.70	78	2.40	436	4.00	910	7.20	1,870
.80	92	2.50	464	4.20	970	7.40	1,930
.90	108	2.60	492	4.40	1,030	7.60	1,990
1.00	124	2.70	520	4.60	1,090	7.80	2,050
1.10	142	2.80	550	4.80	1,150	8.00	2,110
1.20	160	2.90	580	5.00	1,210	8.50	2,260
1.30	180	3.00	610	5.20	1,270	9.00	2,410
1.40	200	3.10	640	5.40	1,330	9.50	2,560
1.50	220	3.20	670	5.60	1,390	10.00	2,710
1.60	242	3.30	700	5.80	1,450	11.00	3,010
1.70	264	3.40	730	6.00	1,510	12.00	3,310
1.80	286	3.50	760	6.20	1,570	13.00	3,610
1.90	310	3.60	790	6.40	1,630	14.00	3,910
2.00	334						

[a] Above gage height 2.0 feet this table is the same as the 1901 table.
[b] Above gage height 1.8 feet this table is the same as the 1902 table.
[c] Above gage height 4.2 feet the rating curve is a tangent, the difference being 30 per tenth.
[d] Above gage height 2.70 feet the rating curve is a tangent, the difference being 30 per tenth.

Estimated monthly discharge of Apalachee River near Buckhead.

[Drainage area, 440 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.					
	2,972	470	847	1.92	2.21
	3,660	552	1,123	2.55	2.84
	1,680	388	553	1.26	1.45
	2,147	552	910	2.07	2.31
	1,460	333	582	1.32	1.52
	2,607	305	896	2.04	2.35
ber	3,247	305	711	1.62	1.81
r	525	280	349	.79	.91
ber	415	280	326	.74	.83
ber	5,772	333	1,027	2.33	2.69
1902.					
y	2,835	525	842	1.91	2.20
ry	5,310	827	1,708	3.88	4.04
	6,685	717	1,714	3.90	4.50
	2,010	552	843	1.92	2.14
	580	300	448	1.02	1.18
	1,322	280	469	1.07	1.19
	1,460	256	375	.85	.98
	1,047	205	368	.84	.97
ber	910	241	495	1.12	1.25
r	497	256	294	.67	.77
ber	525	241	298	.68	.76
ber	1,185	388	641	1.46	1.68
he year	6,685	205	708	1.61	21.66
1903.					
y	635	360	481	1.09	1.26
ry	4,485	497	1,522	3.46	3.60
	3,935	635	1,406	3.20	3.69
	2,422	552	1,009	2.29	2.55
	1,075	310	520	1.18	1.36
	2,560	334	854	1.94	2.16
	2,560	216	593	1.35	1.56
	1,735	203	495	1.12	1.29
ber	2,147	170	407	.93	1.04
r	388	191	287	.65	.75
ber	607	203	348	.79	.88
ber	360	288	328	.75	.86
he year	4,485	170	688	1.56	21.60
1904.					
y	1,655	238	438	0.995	1.15
ry	1,805	308	751	1.71	1.84
	1,415	409	596	1.35	1.56
	907	333	425	.966	1.08
	487	174	286	.650	.749
	595	84	264	.600	.669
	622	100	239	.543	.626
	2,675	238	647	1.47	1.70
ber	568	[a] 62	187	.425	.474
r	216	[a] 43	84.1	.191	.220
ber	333	[a] 126	240	.545	.608
ber	776	216	363	.825	.951
he year	2,675	43	377	.856	11.60
1905.					
y	1,210	286	423	.961	1.11
ry	3,130	286	1,074	2.44	2.54
	640	310	448	1.02	1.18
	410	264	346	.786	.877
	1,120	160	469	1.07	1.23
	1,090	100	345	.784	.875
	2,770	124	624	1.42	1.64
	1,990	[a] 44	462	1.05	1.21
ber	640	[a] 45	145	.330	.368
r	210	[a] 55	139	.316	.364
ber	492	[a] 79	209	.475	.530
ber	3,910	200	1,371	3.12	3.60
he year	3,910	[a] 44	505	1.15	15.52

[a] See note to gage-height table.

OHOOPEE RIVER NEAR REIDSVILLE.

This station was established June 13, 1903, by F. A. Murray. It is located at the wooden highway bridge, known as Sheppards Bridge, 4½ miles west of Reidsville.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the outer edge of the first crossbeam at the left end of the bridge, downstream side. The original gage consisted of two 5-foot sections spiked to the bridge and a third section fastened to a cypress tree on the left bank above the bridge. June 10, 1905, the gage was changed to the right side of the second bent from the left bank; it is fastened to the bent in four 5-foot sections. The gage is read by J. D. Swain, who is paid by the Georgia Geological Survey. Bench marks were established as follows: (1) The top of the cap of the fifth bent from the left end of the bridge on the upstream side, opposite a point 106 feet from the initial point for soundings; elevation, 20.00 feet; (2) two nails driven horizontally into the downstream side of a cypress tree on the left bank, about 120 feet above the bridge; elevation, 8.00 feet. Elevations refer to datum of gage.

Discharge measurements of Ohoopee River, near Reidsville.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
June 13	12.47	5,762	September 13	4.20	838
June 24	6.41	1,692	September 14	3.63	638
July 16	10.34	3,667	September 15	3.00	470
July 16	10.40	3,756	September 15	3.00	454
August 22	14.00	6,441	October 31 [a]	.32	32
October 8	2.84	476	December 1	1.56	190
October 8	2.85	462	1905.		
November 19	4.96	1,131	March 16	11.90	4,204
December 20	6.69	1,836	March 17	11.90	4,163
1904.			April 27	6.38	1,635
February 19	10.19	3,611	June 10	1.01	114
April 13	4.53	1,038	July 28	2.31	362
July 23	2.28	360	November 8 [b]	.36	57
September 13	4.20	823	November 8 [b]	.34	56

[a] Wading 1,000 feet above the bridge. Three narrow channels.
[b] Made at different section.

Daily gage height, in feet, of Ohoopee River, near Reidsville.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
1							8.6	2.0	4.6	3.3	2.4	3.9
2							8.3	2.1	4.3	3.1	2.4	3.7
3							8.4	2.7	4.5	2.9	2.4	3.6
4							7.7	3.4	4.0	2.8	3.1	3.4
5							6.8	3.7	3.5	2.6	3.9	3.3
6							6.0	4.0	3.4	2.5	4.6	3.2
7							5.5	3.9	3.2	2.7	5.2	3.1
8							5.5	3.3	3.5	2.9	5.3	3.1
9							5.7	3.1	3.5	2.9	5.7	3.3
10							6.0	3.6	3.2	2.7	5.0	3.4

Daily gage height, in feet, of Ohoopee River, near Reidsville—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
							7.3	4.2	2.3	2.6	5.1	3.6
							6.6	5.3	2.4	2.3	4.8	3.6
							6.5	4.6		2.2	4.7	3.5
							7.4	3.8		2.1	4.1	3.5
							9.7	3.8		2.0	5.3	3.4
							10.6	8.3		2.0	5.4	3.3
							9.5	10.3		2.2	5.6	3.3
							9.6	9.9		5.0	5.4	3.1
							10.3	10.3		6.7	5.0	3.0
							9.5	14.0	10.8	6.9	4.7	2.9
							8.1	13.8	10.5	6.5	4.5	3.0
							6.7	14.0	8.4	5.7	4.4	3.3
							5.7	13.2	7.2	5.0	4.3	3.3
						6.5	4.7	12.0	6.5	4.6	4.1	3.2
						6.7	4.0	11.4	6.4	3.7	4.0	3.3
						6.9	4.0	10.5	6.3	3.2	4.1	3.7
						7.7	3.7	9.0	4.3	2.9	4.8	5.3
						8.7	3.2	7.7	4.1	2.7	4.4	6.3
						10.2	2.5	6.7	3.9	2.5	4.2	6.6
						9.3	2.5	5.5	3.6	2.3	4.1	6.7
							2.2	4.8		2.2		6.3
1904.												
	6.4	6.7	8.2	4.4	1.4	.9	.5	1.1	8.3	1.1	.3	1.6
	6.6	6.4	7.8	4.8	1.4	1.6	.5	1.0	6.4	1.0	.3	1.4
		6.0	7.3	4.1	1.3	1.8	.5	2.2	6.5	1.0	.7	1.6
	6.1	5.6	7.0	3.8	1.3	1.5	.6	4.6	6.0	.9	1.05	1.8
	6.0	5.3	7.1	3.5	1.3	1.2	1.0	6.2	5.2	.8	1.5	2.1
	5.4	5.0	7.1	3.3	1.1	1.1	1.2	8.4	4.3	.8	1.5	2.8
	4.8	4.8	7.1	3.0	1.1	1.0	1.1	9.0	4.8	.7	1.5	3.1
	4.6	5.0	7.4	2.9	1.0	.9	1.0	9.8	5.6	.6	1.3	3.1
	4.8	5.1	7.8	2.8	1.0	.7	.8	9.0	5.6	.7	1.0	3.0
		6.0	8.0	3.8	1.0	.7	1.1	8.4	5.5	.7	.9	2.8
		8.2	8.0	4.6	.9	.6	1.4	8.6	5.1	.7	.8	2.7
		12.1	7.8	4.8	.9	.6	1.0	9.0	5.0	.7	.7	2.5
		12.0	7.6	4.7	.8	.6	1.0	9.4	4.4	.6	1.0	2.5
			7.5	4.4	.8	.5	.8	8.9	3.6	.6	1.5	2.4
		11.5	7.1	3.4	.7	.5	.6	8.6	3.1	.7	1.9	2.3
		11.2	6.9	3.1	.7	.5	.8	8.3	2.6	.6	2.0	2.2
	2.6	11.0	6.6	2.8	.7	.5	.6	7.6	2.3	.6	1.8	2.2
	2.4	10.7	6.2	2.3	.7	.4	.5	6.3	2.1	.5	1.5	2.2
	2.4	10.1	5.9	2.1	.6	.4	.5	6.4	1.9	.5	1.3	2.1
	2.3	9.4	5.7	2.0	.6	.5	.4	5.4	1.6	.4	1.2	2.1
	2.3	9.3	5.3	1.9	.6	.4	.4	4.8	1.5	.4	1.1	2.0
	2.9	9.8	5.1	1.8	.6	.9	.6	4.5	1.5	.4	1.0	2.0
	3.1	10.1	4.9	1.8	.5	.8	2.3	3.9	2.1	.4	1.1	1.9
	4.0	10.4	4.6	1.7	.5	.6	1.9	3.7	2.2	.4	1.6	1.9
	4.8	10.2	4.7	1.6	.5	.6	1.7	3.9	1.9	.3	1.2	1.9
	5.7	9.8	4.8	1.5	.5	.5	1.5	3.9	1.7	.3	2.7	1.8
	6.4	9.3	4.6	1.4	.5	.5	1.5	3.9	1.5	.4	2.4	1.9
	7.2		4.8	1.4	.5	.5	1.4	5.4	1.3	.4	2.2	2.0
	7.8	8.5	4.9	1.5	.9	.5	1.5	6.3	1.2	.3	1.8	2.4
	7.1		5.0	1.5	1.1	.5	1.5	9.2	1.2	.3	1.6	2.7
	6.8		4.6		.8		1.3	9.2		.3		2.7
1905.												
	2.8	3.6	9.7	6.2	5.3	1.9	1.0	2.5	1.7	.7	.7	.6
	2.9	3.7	9.1	5.9	5.3	1.7	1.2	2.4	1.5	.8	.6	.6
	2.7	3.5	8.7	5.4	5.2	1.5	1.3	2.1	1.3	1.0	.6	.9
	2.5	3.4	8.2	5.2	5.1	1.4	1.3	2.0	1.4	.9	.5	1.0
	2.4	3.5	7.9	5.1	5.3	1.4	1.2	1.7	1.7	.8	.4	1.9
	2.3	3.7	7.5	5.3	5.2	1.4	3.4	1.0	2.0	.7	.4	2.6
	2.4	4.2	7.2	5.6	4.8	1.3	5.1	1.1	1.7	.6	.4	2.6
	2.7	4.5	7.0	5.4	4.0	1.1	5.8	1.0	1.4	.6	.4	2.2
	3.0	5.0	6.8	5.0	3.7	1.0	6.0	1.0	1.1	.5	.4	1.8
	3.3	5.7	7.1	4.9	3.5	1.0	6.3	1.0	.9	.5	.4	1.9
	3.3	5.9	7.4	5.2	3.2	.9	5.9	1.4	.8	.5	.4	2.0
	3.5	6.8	8.9	5.5	2.9	.9	5.8	1.8	.8	.5	.4	2.1
	3.9	8.6	10.5	6.1	2.7	.8	5.2	2.0	.7	.4	1.5	2.1
	4.8	10.2	11.3	6.7	2.4	1.8	4.5	2.8	.7	.4	1.8	1.8
	5.0	12.7	11.7	7.6	2.1	1.4	3.7	3.7	.9	.4	1.6	1.9

Daily gage height, in feet, of Ohoopee River, near Reidsville—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1905.											
16	5.2	15.9	11.9	7.9	1.9	1.8	4.8	3.7	1.4	0.4	
17	5.5	19.0	11.9	8.2	1.9	1.3	5.0	3.5	1.3	.4	
18	5.5	15.0	11.6	7.3	2.3	1.4	4.7	3.3	1.5	.4	
19	5.1	14.6	11.3	7.2	2.7	1.4	5.0	3.3	1.3	.4	
20	4.9	13.7	11.1	7.2	2.8	1.5	5.7	3.1	1.0	.4	
21	4.7	11.8	10.4	6.5	2.7	1.3	4.7	3.0	.9	.4	
22	4.6	11.6	9.6	6.1	2.6	1.3	3.8	2.7	.8	.4	
23	4.5	12.0	9.0	6.8	2.4	1.3	3.0	2.5	.5	.4	
24	4.3	12.5	8.5	7.0	2.6	1.3	2.6	2.5	.6	.3	
25	4.2	12.2	8.3	7.2	3.0	1.2	2.1	2.1	.5	.3	
26	4.2	11.7	8.0	6.9	3.2	1.0	1.8	2.1	.5	.3	
27	4.1	11.1	7.9	6.2	3.2	1.2	1.7	2.8	.5	.4	
28	4.0	10.5	7.8	5.9	2.8	1.2	2.3	3.1	.5	.4	
29	3.8	.....	7.4	5.6	2.2	1.0	2.9	2.9	.5	.7	
30	3.6	.....	7.1	5.4	2.0	1.0	2.7	2.5	.6	.9	
31	3.6	.....	6.7	.....	2.0	.....	2.6	2.1	.....	.8	.....

Rating tables for Ohoopee River, near Reidsville.

JUNE 23, 1903, TO DECEMBER 31, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet*
2.00	280	3.30	595	5.20	1,220	7.80	2,325
2.10	296	3.40	625	5.40	1,295	8.00	2,415
2.20	314	3.50	655	5.60	1,375	8.50	2,665
2.30	326	3.60	685	5.80	1,455	9.00	2,915
2.40	350	3.70	715	6.00	1,535	9.50	3,175
2.50	375	3.80	745	6.20	1,615	10.00	3,465
2.60	400	3.90	775	6.40	1,695	10.50	3,775
2.70	426	4.00	805	6.60	1,785	11.00	4,130
2.80	453	4.20	870	6.80	1,875	12.00	4,935
2.90	480	4.40	940	7.00	1,695	13.00	5,840
3.00	508	4.60	1,010	7.20	2,055	14.00	6,840
3.10	536	4.80	1,080	7.40	2,145		
3.20	565	5.00	1,150	7.60	2,235		

JANUARY 1, 1904, TO DECEMBER 31, 1905.

0.30	50	1.60	197	3.80	690	7.00	1,970
.40	57	1.70	213	4.00	755	7.50	2,184
.50	65	1.80	230	4.20	824	8.00	2,430
.60	74	1.90	247	4.40	895	8.50	2,685
.70	83	2.00	265	4.60	968	9.00	2,950
.80	93	2.20	302	4.80	1,043	9.50	3,222
.90	101	2.40	341	5.00	1,120	10.00	3,500
1.00	115	2.60	382	5.20	1,198	11.00	4,120
1.10	127	2.80	425	5.40	1,277	12.00	4,820
1.20	140	3.00	470	5.60	1,357	13.00	5,590
1.30	153	3.20	519	5.80	1,438		
1.40	167	3.40	572	6.00	1,520		
1.50	182	3.60	629	6.50	1,728		

Estimated monthly discharge of Ohoopee River near Reidsville.

[Drainage area 1,280 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
ne 24-30	3,585	1,740	2,455	1.92	0.500
ly	3,840	314	1,872	1.46	1.68
igust	6,860	280	2,344	1.83	2.11
ptember 1-12 and 20-30 [a]	3,980	326	1,252	.978	.837
tober	1,920	280	654	.511	.589
vember	1,415	350	966	.755	.842
cember	1,830	480	775	.605	.698
1904.					
nuary	2,330	321	1,062	.830	.957
bruary	4,894	1,043	2,877	2.25	2.43
arch	2,531	968	1,703	1.33	1.53
ril	1,043	167	495	.387	.432
ay	167	65	101	.079	.091
ne	230	57	91.8	.072	.080
ly	321	57	125	.098	.113
igust	3,388	115	1,811	1.41	1.63
ptember	2,582	140	747	.584	.652
tober	127	50	74.0	.058	.067
vember	403	50	170	.133	.148
cember	494	167	316	.247	.285
The year	4,894	50	798	.623	8.42
1905.					
nuary	1,317	321	744	.581	.670
bruary	10,390	572	3,512	2.74	2.85
arch	4,746	1,815	2,980	2.34	2.70
ril	2,531	1,081	1,625	1.27	1.42
ay	1,237	247	588	.459	.529
ne	247	93	154	.120	.134
ly	1,643	115	750	.586	.676
igust	659	115	349	.273	.315
ptember	265	65	126	.098	.109
tober	115	50	69.4	.054	.062
vember	230	57	89.9	.070	.078
cember	2,531	74	860	.672	.775
The year	10,390	50	988	.772	10.32

[a] Missing dates, gage out.

ISCELLANEOUS MEASUREMENTS IN ALTAMAHA RIVER DRAINAGE BASIN.

Alcovy River.—The following measurement was made October 7, 904, from the wagon bridge at Henderson's mill, 4 miles from New- n Factory, on the road to Covington. The bench mark is the ostream edge of the bridge floor, 90 feet from the initial point for undings, 11.00 feet above the datum of the gage.

Width, 40 feet; area, 43 square feet; mean velocity, 1.46 feet per second; gage ight, 1.25 feet; discharge, 62 second-feet.

Beaverdam Creek.—This stream enters Oconee River from the left. he following measurement was made March 19, 1904, at Veazey ord, 6 miles south of Greensboro, on the road to Sparta. The nch mark is a nail in a small ash tree on the left bank, 20 feet low the foot plank, 3.00 feet above the datum of the gage.

Width, 15 feet; area, 10 square feet; mean velocity, 1.70 feet per second; gage ight, 1.50 feet; discharge, 17 feet.

Brazzell Creek.—The following measurement was made by wading at a narrow channel one-fourth mile above the mouth and one-half mile from the regular gaging station on Ohoopee River at Reidsville. The gage height at the Ohoopee River station at the same time was 2.35 feet.

July 28, 1905. Width, 12 feet; area, 6.6 square feet; mean velocity, 0.85 foot per second; discharge, 5.6 second-feet.

Glady Creek.—At the wagon bridge, 3½ miles from Eatonton, this stream was discharging 7 second-feet on December 17, 1903, when the water surface was 6.14 feet below bridge floor 60 feet from right end of bridge going upstream.

Horse Creek.—This stream is a tributary of Ocmulgee River from the left. The measurement below was made September 8, 1904, 1½ miles above the mouth of the creek, 10 miles north of Lumber City. The bench mark is a nail driven into the end of the second floor beam above the second bent from the left bank, 15.00 feet above the zero of the gage.

Width, 55 feet; area, 115 square feet; mean velocity, 1.03 feet per second; gage height, 3.17 feet; discharge, 118 second-feet.

Indian Creek.—This stream was measured at wagon bridge at Hudson's mill, 6 miles northwest of Eatonton. The bench mark is at top of bridge floor, 27½ feet from end of hand rail, right bank, upstream.

October 18, 1903: Height of bench mark above water, 8.79 feet; discharge, 85 second-feet.

December 17, 1903: Height of bench mark above water, 9.10 feet; discharge, 49 second-feet.

Jacks Creek.—A measurement was made from a foot log on the river road about one-fourth mile above Hayden's bridge, about one-half mile from Annistown. The bench mark is the head of a large wire nail driven into the downstream face of a double-trunk birch tree on the right bank, 20 feet below the road; elevation, 5.00 feet above the datum of the assumed gage.

January 28, 1905: Width, 8.5 feet; area, 3.7 square feet; mean velocity, 1.32 feet per second; gage height, 1.88 feet; discharge, 4.9 second-feet.

Little Ocmulgee River.—A measurement was made July 26, 1905, by wading about 90 feet upstream from the wagon bridge on which a bench mark was established in September, 1904, three-fourths mile northeast of Lumber City, Ga. The bench mark is the top of the downstream end of the cap of the second bent from the right bank; elevation, 23.00 feet above the datum of the assumed gage.

Width, 48 feet; area, 25 square feet; mean velocity, 1.64 feet per second; gage height, 1.46 feet; discharge, 41 second-feet.

This stream was measured also at a wooden wagon bridge 2½ miles from Lumber City and one-eighth mile from Wilcox Station, Ga.

The bench mark is the center of a lag screw driven into the end of the second floor beam from the right bank of the downstream side; elevation, 18.00 feet above the datum of the assumed gage.

September 7, 1904: Width, 100 feet; area, 488 square feet; mean velocity, 1.92 feet per second: gage height, 3.15 feet; discharge, 9.37 second-feet.

July 25, 1905: Width, 52.5 feet; area, 61.5 square feet; mean velocity, 0.58 foot per second: gage height, 1.25 feet; discharge, 35.5 second-feet.

Little River.—This stream enters Oconee River from the right. It was measured at a wagon bridge 6¼ miles northwest of Eatonton. The bench mark is top of bridge floor, 20 feet from end of bridge, on left bank going upstream.

October 18, 1903: Height of bench mark above water, 8.73 feet; discharge, 118 second-feet.

December 17, 1903: Height of bench mark above water, 9.07 feet; discharge, 88 second-feet.

A measurement was made from the wagon bridge 9 miles north of Milledgeville, 1 mile above the mouth of the river. The initial point for soundings is the end of the hand rail at the left bank. The bench mark is a copper brand in the top of the downstream end of the cross beam at the first pier from the left bank; elevation, 15.00 feet above the datum of the assumed gage.

July 28, 1904: Width, 89 feet; area, 65 square feet; mean velocity, 1.09 feet per second: gage height, 3.17 feet; discharge, 71 second-feet.

September 15, 1905: Width, 99 feet; area, 92 square feet; mean velocity, 1.23 feet per second: gage height, 3.51 feet; discharge, 113 second-feet.

November 24, 1905: Width, 119 feet; area, 132 square feet; mean velocity, 1.55 feet per second; gage height, 3.86 feet; discharge, 205 second-feet.

Ocmulgee River.—This stream was measured at Holton. The bench mark is two nails in upstream side of birch tree 20 feet above old ferry landing, right bank.

October 14, 1903: Height of bench mark above water, 7.1 feet; discharge, 893 second-feet.

October 14, 1903: Height of bench mark above water, 7.0 feet; discharge, 963 second-feet.

At Bridges Ferry, near Berner, this stream was discharging 1,535 second-feet on June 16, 1903; gage height, 3.77 feet. The bench mark is a nail in birch tree at upper side of ferry landing, on right bank; elevation, 10.91 feet above datum.

Oconee River.—Measurements were made at Fraleys Ferry, 6 miles upstream from Milledgeville. The bench mark is a nail in an ash tree on the right bank, 100 feet above the ferry, 10.00 feet above the datum of the gage.

June 29, 1904: Width, 270 feet; area, 1,310 square feet; mean velocity, 0.79 foot per second: gage height, 4.90 feet; discharge, 1,030 second-feet.

September 20, 1904: Width, 207 feet; area, 1,108 square feet; mean velocity, 0.50 foot per second; gage height, 4.35 feet; discharge, 547 second-feet.

Ohoopee River.—At Jarrell Bridge, near Ohoopee, this stream was discharging 1,481 second-feet on June 8, 1903, when the water surface was 7.1 feet below the top of crossbeam, 58 feet from end of hand rail on right bank going downstream.

A measurement was made July 29, 1905, at Lynn Bridge, near Ohoopee. The initial point for soundings was the end of the hand rail at the left bank, downstream side. The bench mark was the top of the upstream end of the cap of the bent, 64 feet from the left end of the hand rail; elevation, 19.00 feet above the datum of the assumed gage.

Width, 84 feet; area, 314 square feet; mean velocity, 0.57 foot per second; gage height, 1.22 feet; discharge, 180 second-feet.

Pendleton Creek.—This stream was measured at Gordon Bridge, 3½ miles from Lyons. In 1903 the bench mark was a spike in a tupelo tree on right bank, 30 feet below bridge. This was carried away by a flood, and the 1905 measurement was dependent on a new bench mark, the top of the downstream end of the cap of the third bent from the right-bank end of the bridge; elevation, 17.00 feet above the datum of the assumed gage.

June 8, 1903: Height of bench mark above water, 5.30 feet; discharge, 1,071 second-feet.

October 7, 1903: Height of bench mark above water, 11.60 feet; discharge, 100 second-feet.

October 7, 1903: Height of bench mark above water, 11.25 feet; discharge, 104 second-feet.

July 29, 1905: Width, 74 feet; area, 341 square feet; mean velocity, 1.23 feet per second; gage height, 7.58 feet; discharge, 138 second-feet.

Pole Bridge Creek.—This stream is a tributary of South River from the left near Lithonia. Measurements were made near the mouth of the creek, on the road between News Bridge and Parker Bridge.

July 16, 1904: Width, 15 feet; area, 7 square feet; mean velocity, 1.43 feet per second; discharge, 10 second-feet.

September 23, 1904: Width, 17 feet; area, 7 square feet; mean velocity, 1.00 foot per second; discharge, 7 second-feet.

Sanford Creek.—At wagon bridge, 3 miles from Eatonton, this stream was discharging 3.6 second-feet on December 17, 1903, when the water surface was 5.44 feet below bridge floor 21 feet from post on right bank.

Snapping Shoals Creek. A measurement was made October 24, 1905, at a bridge about 80 feet above the mouth of Snapping Shoals Creek, 400 feet below the bridge on South River at Snapping Shoals. The bench mark is the top of the wooden stringer 13½ feet from the left-bank end; elevation, 12.00 feet above the datum of the assumed gage.

Width, 21 feet; area, 12 square feet; mean velocity, 1.17 feet per second; gage height, 0.54 foot; discharge, 14 second-feet.

South River.—A measurement was made on South River October 24, 1905, from a boat, just below the mouth of Snapping Shoals Creek, and about 500 feet below the wagon bridge at Snapping Shoals. The bench mark is the top of the downstream end of the first floor beam of the bridge to the left of the center pier; elevation, 26.00 feet above the datum of the assumed gage.

Width, 78 feet; area, 122 square feet; mean velocity, 1.18 feet per second; gage height, 3.00 feet; discharge, 144 second-feet.

A measurement was made October 7, 1904, at the wagon bridge, 10 miles from Jackson, on the road to Covington. The bench mark is the upstream end of floor beam, 66 feet from the initial point for soundings, 20.00 feet above the datum of the gage.

Width, 121 feet; area, 152 square feet; mean velocity, 0.90 foot per second; gage height, 1.10 feet; discharge, 137 second-feet.

Sugar Creek.—A measurement was made on this stream September 7, 1904, from the Southern Railway bridge, one-fourth mile north of Wilcox. The bench mark is the top of the steel girder, upstream side, 150 feet from the right end of the trestle, 25.00 feet above the datum of the gage.

Width, 41 feet; area, 117 square feet; mean velocity, 1.06 feet per second; gage height, 7.50 feet; discharge, 124 second-feet.

Another measurement was made July 25, 1905, at a new wagon bridge 75 feet upstream from the Southern Railway bridge at Wilcox. The bench mark is the top of the downstream wooden stringer 126 feet from the right end of the downstream hand rail of the bridge; elevation, 22.06 feet above the datum of the assumed gage.

Width, 15 feet; area, 18 square feet; mean velocity, 0.30 foot per second; gage height, 3.88 feet; discharge, 5.5 second-feet.

Swift Creek.—Near Lyons, this stream was discharging 31 second-feet on October 7, 1903.

Town Creek.—At wagon bridge, 1 mile east of Eatonton, this stream was discharging 2.7 second-feet on December 18, 1903, when the water surface was 8.57 feet below top of bridge floor, 24 feet from right end of bridge, going downstream.

Yellow River.—At Woods Bridge, near Almon, this stream was discharging 79 second-feet on September 12, 1903, when the water surface was 17.46 feet below top of crossbeam, 75 feet from right end of bridge going downstream.

At a wagon bridge near Lithonia this stream was discharging 104 second-feet on October 5, 1903, when the water surface was 16.25 feet below top of wooden stringer on downstream side of bridge, at inside face of right-bank stone abutment.

A measurement was made at this place September 15, 1905. The bench mark is the top of the downstream corner of the right-bank

stone abutment; elevation, 16.55 feet above the datum of the assumed gage.

Width, 28 feet; area, 40 square feet; mean velocity, 1.70 feet per second; gage height, 1.96 feet; discharge, 68 second-feet.

A measurement was made October 7, 1904, at the wagon bridge 11 miles from Jackson, on the road to Covington. The bench mark is the downstream edge of the bridge floor, 40 feet from the initial point for soundings, and is 8.00 feet above the datum of the gage.

Width, 113 feet; area, 229 square feet; mean velocity, 0.30 foot per second; gage height, 1.80 feet; discharge, 69 second-feet.

RIVER SURVEYS IN ALTAMAHA RIVER DRAINAGE BASIN.

SOUTH RIVER.

The elevations in the following lists are based upon an aluminum tablet at the Washington street entrance of the State capitol building at Atlanta, marked "1050 M. C.," the elevation of which is accepted as 1,049.546 feet above mean sea level.

The leveling on South River is adjusted to accord with elevations of precise-level bench marks at Constitution, Holton, and Macon, by the 1903 adjustment. The leveling was done in 1903 for the United States Geological Survey by Joseph Palmer, levelman, under the direction of F. A. Franck, field assistant.

Elevations on South River from Constitution to mouth.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0.0	Iron post 4 feet east of signboard "Constitution," 25 feet south of railroad	847.0
1.0	60 feet below Southern Railway bridge, water surface	[illegible]
2.0	Black-gum tree opposite mouth of Intrenchment Creek	[illegible]
2.0	Water surface	[illegible]
2.8	Sycamore tree 35 feet south of creek, 50 feet east of road at McNeals Bridge	[illegible]
2.8	Water surface	[illegible]
3.9	Junction of South River and Sugar Creek, water surface	[illegible]
4.1	40 feet east of road at south approach, Surges Bridge	[illegible]
5.8	Mouth of small stream, water surface	[illegible]
6.3	15 feet below road, north approach of bridge	[illegible]
7.0	Kellers Bridge, iron bolt on north end	[illegible]
7.0	Kellers Bridge, water surface	[illegible]
7.06	Blue Creek, 100 yards below Kellers Bridge, water surface	[illegible]
8.0	Mouth small creek, water surface	[illegible]
9.1	Water surface	[illegible]
10.0	Shoal Creek Bridge, water surface	[illegible]
10.05	Mouth of Shoal Creek, water surface	[illegible]
10.1	15 feet above Waldrops Bridge, water surface	[illegible]
11.0	At mouth small stream, one-fourth mile below Waldrops Bridge, water surface	[illegible]
11.8	Fork Creek, 5 feet below bridge, water surface	[illegible]
12.0	Water surface	[illegible]
12.3	Lower end of island, water surface	[illegible]
12.6	Birch tree at small stream	[illegible]
12.6	Water surface	[illegible]
13.5	Flake's mill, top of dam	[illegible]
13.6	Flake's mill, bottom of dam	[illegible]
13.6	In rapids below dam, water surface	[illegible]
14.0	Water surface	[illegible]
14.2	Below rapids, water surface	[illegible]
14.3	Above riffs, water surface	[illegible]
14.32	Below riffs, water surface	[illegible]
14.8	Water surface	710

Elevations on South River from Constitution to mouth—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
15.0	Opposite mouth Snapfinger Creek, water surface	710
15.3	Above shoals just below Snapfinger Creek, water surface	709.7
15.35	Below shoals just below Snapfinger Creek, water surface	708
15.8	At mouth of Mathews Creek, water surface	701
16.1	100 feet below mouth of Cucumber Creek, water surface	698
16.3	Flat Shoals Bridge, on stone masonry, south side of river, east side of approach	708.71
16.5	Flat Shoals Bridge, water surface	698
16.3	Below Flat Shoals, water surface	686
18.0	Mouth of small stream, water surface	683
18.6	50 feet above small stream opposite Little Mountain, water surface	683
19.0	Water surface	682
19.9	At bend of river just below Little Mountain, water surface	681
20.6	Parkers Bridge on sweet-gum tree south side of river, 50 feet from bridge, 6 feet from road	678.76
20.6	Parkers Bridge, water surface	672
20.7	Opposite Pole Bridge Creek, water surface	670
22.0	50 feet below Albert Shoals Bridge, water surface	669.50
22.05	Mouth small stream, head of Albert Shoals, water surface	667
22.6	At old mill, water surface	660
22.6	Below falls, water surface	653
23.2	Opposite mouth of Crooked Creek, water surface	651
23.6	Daniels Bridge, top stone pier, lower side, right end	667.97
23.6	Daniels Bridge, water surface	649
23.7	Head of shoals below Daniels Bridge, water surface	647
23.75	Foot of shoals below Daniels Bridge, water surface	645
24.0	Mouth of small creek from right bank, water surface	644
24.5	25 feet below mouth of creek, right bank, water surface	643
24.8	Head of Pucket Shoals, water surface	642
.....	Foot of Pucket Shoals, water surface	639
24.9	Foot of lower Pucket Shoals, water surface	637
25.3	Head of shoals, Simms Bridge, water surface	636
.....	Foot of shoals, Simms Bridge, water surface	634
25.7	Opposite mouth of small creek, water surface	631
26.4	Sycamore tree, 50 feet above mouth of Knights Creek	639.28
26.4	Water surface	629
27.0	40 feet below creek, 1 mile below Knights Creek, water surface	626
27.2	At mouth of small creek, about 1¼ miles below Knights Creek, water surface	625
28.9	Water surface	621
29.2	Forty feet above mouth of small stream, water surface	620
30.0	Mouth of small stream, right bank, water surface	619
30.5	About one-half mile below small stream, water surface	618
30.8	Opposite mouth of Honey Creek, water surface	616
31.0	On oak tree, 25 feet above Oglesbys Bridge	622.02
31.0	Water surface	614
31.2	Mouth of Camp Creek, water surface	613
31.4	Mouth of small creek, about one-fourth mile below Oglesbys Bridge, water surface	612.2
33.0	Sixty feet above small stream, about 1 mile below Oglesbys Bridge, water surface	610
33.1	Mouth of small stream, water surface	610
33.9	Mouth of creek about 2 miles below Oglesbys Bridge, water surface	606
34.5	40 feet below mouth of small creek, water surface	604
35.0	Head of shoals (one-half mile), water surface	602
.....	Foot of shoals, water surface	601
35.5	Opposite bend in river	597
36.0	Peachstone Shoals Bridge, water oak	605.71
36.0	Peachstone Shoals Bridge, water surface	597
.....	Peachstone Shoals, head of dam	597
.....	Peachstone Shoals, foot of dam	595
36.1	Peachstone Shoals, foot of rapids	589
36.4	Water surface	588
38.0	Opposite mouth of Cotton River, water surface	587
38.4	Mouth of small stream, water surface	584
39.0	Mouth of small stream below sharp bend in river, water surface	580
39.6	Mouth of small creek, water surface	578
40.0	Mouth of small stream, water surface	575
40.1	Mouth of Walnut Creek, water surface	573
41.0	Red oak 30 feet below Butlers Bridge	587.15
41.0	Butlers Bridge, water surface	569
41.25	Mouth of small creek, water surface	568.5
41.7	....do	568
42.0	Water surface	566
43.0	Head of upper Snapping Shoals, water surface	562
43.02	Foot of upper Snapping Shoals, water surface	561
43.03	Head of Snapping Shoals, water surface	561
43.05	Foot of first falls, water surface	557
43.06	Head of second falls, 180 feet from first fall, water surface	556
43.1	Water oak 40 feet from north approach of Snapping Shoals Bridge	559.66
43.1	Water surface	542
43.2	Foot of rapids, water surface	541
43.8	60 feet above small stream, water surface	538
45.0	Island Shoals, at head of dam, water surface	530

Elevations on South River from Constitution to mouth—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
.....	Island Shoals, at foot of dam, water surface	554
.....	Island Shoals at head, water surface	534
45.25	Island Shoals at foot, water surface	526
45.3	Island Shoals Bridge, white oak at south approach	534.4
45.3	Island Shoals Bridge, water surface	525
47.0	Mouth of creek, water surface	519
47.8	Water surface	518
49.0	Head of small shoals, water surface	512
49.4	Opposite shoals, water surface	511
50.0	Head of shoals one-fourth mile above Manns Bridge, water surface	509
.....	Foot of shoals, water surface	507
50.8	On hickory tree 20 feet below Manns Bridge	518.4
50.8	Water surface	503
51.0	At small creek, water surface	501
51.5	About three-fourths of a mile below Manns Bridge, water surface	500

SURVEY OF OCMULGEE RIVER.

The elevations in the following lists are based upon an aluminum tablet at the Washington street entrance of the State capitol building at Atlanta, marked "1050 M. C.," the elevation of which is accepted as 1,049.546 feet above mean sea level. The leveling is adjusted to accord with elevations of precise-level bench marks at Constitution, Holton, and Macon, by the 1903 adjustment. It was done in 1903 for the United States Geological Survey by Joseph Palmer, levelman, under the direction of F. A. Franck, field assistant.

Elevations on Ocmulgee River from junction of South and Yellow rivers to Macon.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
52.1	Large pine tree opposite mouth of Yellow River	506.94
52.1	Head of shoals	498
53.5	Near end of island, water surface	487
54.0	Head of Lemon Shoals, water surface	486
54.02	Foot of Lemon Shoals, water surface	484
54.5	Large white oak opposite mouth of Alcovy River	494.57
54.5	Water surface	484
54.55	Head of shoals just below Alcovy River, water surface	493
54.56	Foot of shoals just below Alcovy River, water surface	492
54.6	Head of dam in left channel and also head of shoals in right channel at Kees Shoals, water surface	491
54.7	Foot of dam, water surface	479
54.75	Foot of shoals, water surface	477
56.0	Head of shoals one-fourth mile below Kees's mill, water surface	475
56.0	Foot of shoals one-fourth mile below Kees's mill, water surface	473
56.2	Water oak at mouth of Tussahaw Creek	492.12
56.2	Water surface	472
56.5	Dempseys Ferry and head of Cooks Shoals, water surface	472
56.6	Foot of Cooks Shoals, water surface	468
56.9	Head of Lloyds Shoals, water surface	533
57.2	End of small island, water surface	467
58.1	Opposite lower end of last island in shoals, water surface	465
58.8	Shoals, water surface	457
58.5	Foot of Lloyds Shoals, water surface	459
59.5	Pittmans Ferry, large beech tree	434.96
59.5	Pittmans Ferry, water surface	445
59.55	Head of shoals just below Pittmans Ferry	425
59.6	Foot of shoals, water surface	443
60.0	Hickory tree 30 feet above mouth of Yellow Water Creek	433.95
60.0	Water surface	442
61.3	Giles Ferry, large pine tree	430.01
61.3	Giles Ferry, water surface	420
61.35	Smiths Shoals, head of dam, water surface	420
61.35	Smiths Shoals, foot of dam, water surface	418
61.9	Smiths Shoals, near lower end small island, water surface	417
8	Foot of Smiths Shoals, water surface	408

ations on Ocmulgee River from junction of South and Yellow rivers to Macon—Con.

e.	Description of points.	Elevation above sea level.
s.		*Feet.*
	Smiths Ferry, ash tree 20 feet above landing	410.44
	Smiths Ferry, water surface	407
	Head of Lamars Shoals, water surface	406
	Lamars Shoals, head of dam, water surface	403
	Lamars Shoals, foot of dam, water surface	398
	Foot of Lamars Shoals, water surface	387.5
	Lamars Ferry, water surface	384
	Goodmans Ferry, large red oak	400.74
	Goodmans Ferry, water surface	382
	Mouth of Little Sandy Creek, water surface	381
	About one-half mile above Wards Ferry, water surface	377
	Wards Ferry, water oak	392.69
	Wards Ferry, water surface	375
	White paint mark on stone pier 2 feet from end, 4 feet west of western rail Southern Railway bridge over Big Sandy Creek	399.45
	Water surface	374
	Mouth of Big Sandy Creek, water surface	373
	Bridges Ferry, large water oak	382.82
	Bridges Ferry, water surface	370
	Large dead oak about 4 miles below Bridges Ferry	388.15
	Water surface	368
	Large red oak, south bank, Towaliga River	379.34
	Water surface	368
	Head of Glovers Shoals, water surface	366
	Glovers Shoals, head of dam, water surface	362
	Glovers Shoals, foot of dam, water surface	355
	Foot of shoals at Juliette, water surface	351
	Large beech tree 10 feet south of west approach Glovers Ferry	361.10
	Water surface	346
	Mitchells Ferry, red-oak tree 10 feet south of west approach	361.74
	Mitchells Ferry, water surface	344
	Head of small shoals, water surface	343
	Foot of small shoals, water surface	342
	Head of small shoals, water surface	341
5	Foot of small shoals, water surface	339
	About one-half mile below shoals, water surface	337
	Thunderwood tree opposite post on Southern Railway, 1 mile above Dames Ferry, 25 feet from river bank	340.79
	Water surface	330
	Dames Ferry, ash tree 10 feet south of western approach	335.63
	Dames Ferry, water surface	328
	Carsterpher's mill, head of dam, water surface	328
	Carsterpher's mill, foot of dam, water surface	322
	Foot of shoals, water surface	320
	North abutment of Southern Railway bridge, over Rum Creek	347.32
	Water surface	318
	Popes Station, in front of, top of west rail	348.23
	Popes Ferry, water oak	326.88
	Popes Ferry, water surface	318
	Head of shoal about 1 mile below Popes	317
	Foot of shoals	312
	Mouth of Tobler Creek	312
	Above small shoals, water surface	311
4	Below small shoals, water surface	310
	Above small shoals, water surface	309
	Below small shoals, water surface	307
	Above small shoals, water surface	306
	Below small shoals, water surface	304
	Above shoals, water surface	302
	Below shoals, water surface	300
	Iron post marked "339. Morehead—1898" at Holton Station, Southern Railway, 35 feet north of station, 29 feet west of center of track	338.733
	Water surface	299
	Above shoals, about one-fourth mile above Beaverdam Creek, water surface	296
	Foot of shoals, water surface	294
	Head of shoals just above creek, water surface	294
	Foot of shoals just above creek, water surface	291
	Mouth of Beaverdam Creek, water surface	291
5	Head of shoals just below Beaverdam Creek, water surface	290
	Foot of shoals just below Beaverdam Creek, water surface	289
	Head of shoals about one-fourth mile below Beaverdam Creek, water surface	289
	Foot of shoals, water surface	284
	Virgin, point on west rail at upper switch	322.52
	Virgin, water surface	282
	About one-half mile below Virgin, water surface	281
	Pine tree 100 feet below mouth of small creek just below Macon waterworks, and 30 feet east of right-hand track	301.88
	Water surface	278
	At Fifth Street Bridge, Macon, Ga	276
	Check on tablet at P. O., corner Third and Mulberry streets, Macon	333.942

SURVEY OF YELLOW RIVER.

The elevations in the following lists are based upon an aluminum tablet at the Washington street entrance of the State capitol building at Atlanta, marked "1050 M. C.", the elevation of which is accepted as 1,049.546 feet above mean sea level. The initial point is a bench mark of flying levels on Ocmulgee River.

The leveling was done in 1903 for the United States Geological Survey by Joseph Palmer, levelman, under the direction of F. A. Franck, field assistant.

Elevations on Yellow River from mouth to Yellow River.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0.0	Pine opposite mouth of Yellow River	
0.0	Water surface	
0.5	Ash, 10 feet from bank, opposite Indian Fishery Shoals	
.....	Foot of Indian Fishery Shoals, water surface	
.....	Head of Indian Fishery Shoals, water surface	
1.1	Mouth of small stream, water surface	
2.5	Allens Bridge, maple 20 feet from stream on east bank	
2.5	Allens Bridge, water surface	
.....	Foot of Allens Shoals, water surface	
.....	Head of Allens Shoals, water surface	
3.3	Mouth of stream coming in from east, about 3 miles above Allens Shoals, water surface	
4.7	Ash tree, west bank river, Lees Shoals	
4.7	Foot of Lees Shoals, water surface	
.....	Head of Lees Shoals, water surface	
6.2	Picketts Bridge, white oak, east bank	
6.2	Picketts Bridge, water surface	
6.5	Water surface	
7.5	100 feet below small stream, water surface	
9.0	Mouth of small stream, water surface	
10.7	Flat Shoals Bridge, white oak, west bank river	
10.7	Flat Shoals Bridge, water surface	
13.1	Small creek from west, water surface	
13.8	White oak, foot of Langston Shoals, 15 feet from stream, west bank	
13.8	Water surface	
.....	Head of Langston Shoals, water surface	
15.2	Near mouth of small stream, water surface	
16.0	Below shoals, water surface	
.....	Above shoals, water surface	
16.9	Porterdale Shoals, white oak 10 feet from stream, west bank, 60 feet from foot of shoals	
16.9	Porterdale Shoals, water surface	
.....	Porterdale, foot of dam, water surface	
.....	Porterdale, head of dam, water surface	
17.7	Porterdale Bridge, white oak 20 feet from south approach	
17.7	Porterdale Bridge, water surface	
17.7	Porterdale, rod held on top steel post of railing at extreme south end of steel bridge	
18.7	River at sharp bend, water surface	
20.8	Sweet gum 10 feet from stream, 60 feet above Browns Bridge	
20.8	Water surface	
.....	Three-fourths mile above Browns Bridge, water surface	
21.5	About 1 mile above Browns Bridge, water surface	
22.0	At mouth of Hurricane Creek, one-half mile below Woods Bridge, water surface	
22.8	Woods Bridge, poplar tree	
22.8	Woods Bridge, water surface	
23.0	Chisel mark on large rock under Georgia Railroad bridge, west bank	
23.0	Water surface	
23.0	Foot of small shoal under Georgia Railroad bridge, water surface	
23.2	About one-sixth mile above railroad bridge, water surface	
23.7	Small creek, west bank, water surface	
24.3	Hardwick Bridge, water oak on north bank	
24.3	Hardwick Bridge, water surface	
24.8	About one-half mile above bridge, water surface	
25.0	Water surface	
26.0	Water oak opposite mouth of Haynes Creek	
26.0	Water surface	
27.1	Water surface	
28.2	McDaniels Bridge, large water oak on west bank	
28.2	McDaniels Bridge, water surface	

Elevations on Yellow River from mouth to Yellow River—Continued.

Description of points.	Elevation above sea level.
	Feet.
›ot of dam, McDaniels Mill, water surface	632
›ad of dam, McDaniels Mill, water surface	641
›nk, opposite small islands	641
›rge white oak 10 feet below Pinelog Bridge	650. 55
›ter surface	641
›out one-half mile above bridge, water surface	641
›ll pine, left bank, 100 yards above Boartusk Creek	653. 96
›ter surface	644
›ree-tenths mile below Milstead, water surface	645
›e at foot of shoals at Milstead	657. 41
›ter surface	647
›shoals, water surface	657
›shoals, water surface	667
›ot of dam, water surface	677
›p of dam, water surface	692
›lstead, large white oak 40 feet above bridge between main and side tracks, ›outh bank	701. 33
›lstead, water surface	692
›vins Bridge, hickory on west bank, 20 feet above bridge	697. 83
›vins Bridge, water surface	697
›ter oak, east bank, about 1 mile above bridge	700. 62
›ter surface	694
›ter surface	697
›ter surface	698
›hnstons Bridge, on top of iron bolt, extreme end of bridge, eastern entrance	717. 53
›hnstons Bridge, water surface	702
›out 0.6 mile above bridge, water surface	705
›ter surface	707
›low small shoals, water surface	709
›ove small shoals, water surface	711
›hite paint mark on stone masonry to old dam, west bank	722. 88
›ter surface	711
›ad of old dam, water surface	712
›ot of small shoals, water surface	714
›ad of small shoals, water surface	715
›hite oak, 20 feet from stream, opposite small shoals, east bank	730. 91
›ter surface	715
›ad of shoals, water surface	717. 6
›hite oak, opposite mouth of Mountain Creek	727. 91
›ot of shoals, water surface	718
›ad of shoals, water surface	720
›ad of shoals, water surface	723
›ck Bridge, white paint mark on top of stone pier	740. 60
›ck Bridge, water surface	724
›ter surface	726
›h tree, 10 feet from stream, west bank	728. 48
›ter surface	727
›ckory tree, opposite foot of shoals	748. 83
›ter surface	729
›ad of shoals, water surface	733
›ot of shoals, opposite sand island below old Ann.stown, water surface	737
›e-fourth mile below Haydens Bridge, water surface	738
›shoals, water surface	747
›nistown, foot of dam, water surface	760
›nistown, head of dam, water surface	771
›ydens Bridge, large birch on east bank	777. 64
›yards above creek, water surface	771
›sel mark on large rock, opposite old mill, east bank	788. 55
›ter surface	722
›ad of shoals, water surface	786
›out one-half mile above shoals, water surface	787
›xtons Bridge, on top iron bolt, stone pier	809. 94
›ter surface	791
›rge pine, opposite shoals	808. 42
›ter surface	793
›ot of shoals, water surface	797
›ad of shoals, water surface	802
›ckory tree at head of shoals	818. 17
›ter surface	804
›ter surface	807
›llow River Bridge, white oak	825. 41
›llow River Bridge, water surface	815
›ad of shoals, water surface	818
›rge water oak, about 100 yards above Simmons Mill, east bank	834. 86
›mmons Mill, below dam, water surface	819
›mmons Mill, head of dam, water surface	826

SURVEY OF ALCOVY RIVER.

The elevations in the following lists are based upon an aluminum tablet at the Washington street entrance of the State capitol building at Atlanta, marked "1050 M. C.," the elevation of which is accepted as 1,049.546 feet above mean sea level. The initial point is a bench mark of flying levels on Ocmulgee River.

The leveling was done in [illegible] for the United States Geological Survey by [illegible], leveler, under the direction of F. A. [illegible], field assistant.

[illegible] Railway Bridge.

[illegible]	Description of points.	Elevation above sea level.
Miles		Feet.
	[illegible] opposite mouth of Alcovy River...	484.2
	Water surface...	484
	[illegible] bank upstream...	495.5
	Water surface...	497
[illegible]	[illegible] bank upstream...	499.4
[illegible]	Water surface...	492
[illegible]	[illegible]...	50[illegible].5
[illegible]	Water surface...	490
[illegible]	[illegible] bank...	506.7
[illegible]	Water surface...	497
[illegible]	[illegible] bank...	506.[illegible]
[illegible]	Water surface...	50[illegible]
[illegible]	[illegible] M[illegible] bank opposite [illegible]...	512.7
[illegible]	Water surface...	502
[illegible]	[illegible] M[illegible] water surface...	504
[illegible]	[illegible] M[illegible] left bank upstream, nail in root [illegible]...	515.3
[illegible]	Water surface...	505
[illegible]	[illegible] M[illegible] water surface...	50[illegible]
[illegible]	[illegible] N[illegible] F[illegible] water surface...	509
[illegible]	[illegible] opposite [illegible] at White's mill...	562.[illegible]
[illegible]	[illegible] water surface...	551
[illegible]	[illegible] water surface...	556
[illegible]	[illegible] N[illegible] Factory Bridge [illegible] marked with white paint...	562.9
[illegible]	Water surface...	562
[illegible]	[illegible] N[illegible] Factory [illegible] water surface...	562
[illegible]	[illegible]...	615.[illegible]
[illegible]	Water surface...	565
[illegible]	[illegible] water surface...	594
[illegible]	[illegible] water surface...	5[illegible]
[illegible]	[illegible] bank...	604.[illegible]
[illegible]	[illegible]...	597
[illegible]	[illegible]...	604.9
[illegible]	[illegible]...	59[illegible]
	[illegible] water surface...	600
[illegible]	[illegible]...	612.9
[illegible]	[illegible] water [illegible] bank...	620.[illegible]
[illegible]	[illegible]...	6[illegible]
[illegible]	[illegible] post [illegible] right bank...	61[illegible]
[illegible]	Water surface...	604
[illegible]	[illegible] water surface...	60[illegible]
[illegible]	[illegible] water surface...	61[illegible]
[illegible]	[illegible] bridge [illegible] bank...	6[illegible]
[illegible]	[illegible] bridge water surface...	615

SURVEY OF TOWALIGA RIVER.

The elevations in the following lists are based upon an aluminum tablet at the Washington street entrance of the State capitol building at Atlanta, marked "1050 M. C.," the elevation of which is accepted as 1,049.546 feet above mean sea level. The initial point is a bench mark of flying levels on Ocmulgee River.

The leveling was done in 1903 for the United States Geological Survey by Joseph Palmer, levelman, under the direction of F. A. Franck, field assistant.

Elevations on Towaliga River from mouth to High Falls Bridge.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0.0	Water oak, south side at mouth of river	379.34
0.0	Water surface	367
1.7	On root of beech tree, east bank, 50 feet from stream at Lamars Bridge	382
1.7	Water surface	371
2.2	Ash tree one-half mile above Lamars Bridge, at mouth of small creek	377.36
2.2	Water surface	373
3.7	Water surface	376
4.0	Large pine tree 50 feet from river, west bank	412.45
4.0	Water surface	379
4.6	Water surface	382
6.0	Hunting Shoals Bridge, top of iron bolt on stone pier	412.80
6.0	Hunting Shoals Bridge, water surface	386
7.0	Twin water oak 10 feet from stream, north bank going up	399.49
7.0	Water surface	393
8.8	Jacksons Bridge, poplar tree, west bank	409.84
8.8	Jacksons Bridge, water surface	395
9.5	Water surface	397
10.5	Pine, 100 yards above creek, west bank, 10 feet from river	416.15
10.5	Water surface	400
11.8	Water oak, 10 feet below Wilsons Bridge	421.06
11.8	Water surface	406
12.3	Water oak about one-half mile above Wilsons Bridge, west bank	431.01
12.3	Water surface	410
13.3	North Fork, birch tree about 100 yards above junction of North and South forks	416.93
13.3	Water surface	414
14.0	Foot of shoals, water surface	418
.....	Head of shoals, water surface	421
15.0	Foot of shoals, water surface	422
.....	Head of shoals, water surface	428
15.0	Birch tree, north bank, opposite shoals	432.23
15.5	Foot of shoals, water surface	429
15.6	Head of shoals, water surface	434
16.0	Morans Bridge, right bank, white oak 20 feet below bridge	443.61
.....	Morans Bridge, foot of shoals, water surface	437
16.1	Morans Bridge, head of shoals, water surface	439
17.4	Willow opposite shoals	449.74
17.4	Water surface	443
17.5	Foot of shoals, water surface	446
.....	Head of shoals, water surface	450
18.0	Pine at mouth of Tobes Creek	457.48
18.0	Water surface	452
18.5	Foot of shoals, water surface	452
.....	Head of shoals, water surface	454
18.7	Foot of small shoals, water surface	455
.....	Head of small shoals, water surface	457
19.2	Birch tree, south bank, 20 feet above small stream	462.60
21.1	Foot of Long Shoals, white oak	474.31
21.1	Water surface	466
21.2	Foot of High Falls, water surface	492
21.3	High Falls Bridge, north approach, top of iron bolt, west side	563.32
21.3	Water surface	524
21.7	Head of Long Shoals, opposite old dam, water surface	561

SURVEY OF OCONEE AND MIDDLE OCONEE RIVERS.

The survey of Oconee River from Milledgeville to mouth of Apalachee River was made in 1885 by C. A. Locke, assistant engineer, U. S. Army. The survey of Oconee River above mouth of Apalachee River and of Middle Oconee River was made in July and August, 1902, by J. B. High, under the direction of B. M. Hall, of the United States Geological Survey.

Elevations on Oconee and Middle Oconee rivers above Milledgeville.

OCONEE RIVER.

Distance.	Description of points.	E. al
Miles.		
0	Below Treanor's milldam at Milledgeville, water surface	
0	Above Treanor's milldam, water surface	
3.7	Foot of Furmans Shoals, water surface	
4.5	Oconee Electric Power Company's dam site, water surface	
7.5	Fraleys Ferry, water surface	
8.0	Below Fraleys Mill Shoal, water surface	
8.4	Above Fraleys Mill Shoal, water surface	
10.8	Mouth of Little River, water surface	
13.4	Rock Landing, water surface	
14.1	Ferry, water surface	
15.4	Mouth of Crooked Creek (right bank), water surface	
17.2	Mouth of Rocky Creek (right bank), water surface	
22.7	Putnam Mineral Springs(right bank), water surface	
23.9	Mouth of Log Dam Creek (left bank), water surface	
24.6	Warrens Old Ferry, water surface	
26.5	Mouth of Shoulderbone Creek (left bank),water surface	
27.9	Ferry, water surface	
29.5	Foot of shoal, water surface	
30.6	Rope ferry on Laurens Shoals, water surface	
31.9	Below Laurens milldam (8-foot dam), water surface	
31.9	Above Laurens milldam (8-foot dam), water surface	
32.3	Mouth of Richland Creek (left bank), water surface	
33.1	Top of Laurens Shoals, end of pond, water surface	
33.6	Foot of Methodist Fishery or Rileys Shoals, water surface	
34.3	Top of Methodist Fishery or Rileys Shoals, water surface	
35.0	Ferry and old piers, below Spivey's mill, water surface	
35.8	Top of Long Shoals, water surface	
38.2	Foot of Hills Shoal, water surface	
38.6	Top of Hills Shoal, water surface	
45.8	Mouth of Sugar Creek (right bank), water surface	
50.5	Below Parks milldam, water surface	
50.5	Above Parks milldam, water surface	
54.0	Georgia Railroad bridge, Carey, water surface	
54.0	B. M. base of rail, east end of Georgia Railroad bridge, Carey	
58.8	Willis Ferry, cottonwood tree on left bank, north side of road	
58.8	Willis Ferry, water surface	
59.8	Ironwood tree on left bank, 25 feet below mouth of Town Creek	
59.8	Mouth of Town Creek, water surface	
65.0	Hickory on right bank, 10 feet from mouth of Greenbrier Creek	
65.0	Mouth of Greenbrier Creek, water surface	
65.7	Daniels Ferry, large water oak on right bank, 120 feet from river	
65.7	Daniels Ferry, water surface	
66.8	Leaning willow on right bank, opposite mouth of Fishing Creek	
66.8	Mouth of Fishing Creek, water surface	
68.4	Mouth of Harris Creek, water surface	
69.0	One mile below Wrays Ferry and one-half mile above Harris Creek, water surface	
70.0	Wrays Ferry, water surface	
70.0	Wrays Ferry, box elder on right bank, 20 feet from river	
71.2	Mouth of Allison Creek, water surface	
71.2	Mouth of Allison Creek, birch on right bank	
72.7	Mouth of Rose Creek, water surface	
72.7	Large leaning willow, on right bank, 40 feet below Rose Creek	
72.9	Scull Shoals, 125 feet above ferry, water surface	
72.9	Scull Shoals, white oak on left bank, 125 feet above ferry	
76.2	Mouth of Falling Creek, water surface	
76.2	Maple leaning over Falling Creek, on left bank, 50 feet above mouth	
78.6	Mouth of Big Creek, water surface	
78.6	Large maple on left bank of Big Creek, 75 feet from mouth	
83.3	Mouth of Shoal Creek, water surface	
83.3	Sycamore on left bank of Shoal Creek, 8 feet from mouth	
83.7	Foot of Barnetts Shoals, water surface	
83.7	Foot of Barnetts Shoals, willow on left bank	
86.0	Top of Barnetts Shoals, 600 feet below bridge, water surface	
86.0	Large mulberry on left bank, 600 feet below Barnetts Bridge	
86.1	Barnetts Bridge, water surface	
86.1	Barnetts Bridge, nail in right bank pier, 1½ feet above ground	
87.5	Mouth of Cedar Creek, water surface	
88.9	Junction of North Oconee and Middle Oconee rivers, water surface	
88.9	Twin willow on right bank, opposite mouth of North Oconee	

n Oconee and Middle Oconee rivers above Milledgeville—Continued.

MIDDLE OCONEE RIVER.

Description of points.	Elevation above sea level.
	Feet.
ilroad bridge, water surface	525.3
wagon bridge, water surface	530.2
-bank pier, 2 feet from ground	544.08
outh of Barbers Creek, water surface	536
Factory, 60 feet below end of tailrace, water surface	541
n left bank, 100 feet above Princeton Bridge	546.31
Factory, headrace above wheels, water surface	557.4
l Creek, water surface	558.9
ch on left bank, 75 feet below Bobbin Mill Creek	566.32
ings Shoal, water surface	561.5
ings Shoal, water surface	566.5
old masonry pier, 30 feet from river, left bank	575.03
ce at Mitchells Bridge	572.2
tream face of left bank pier, 5 feet from ground	577.15
at Athens electric plant, water surface	598.3
ir Line railroad bridge, water surface	599
llassee Shoal, water surface	607.5
at mouth of tailrace, left bank	624.67
m at Tallassee Bridge water power, water surface	654.5
headrace, Tallassee Bridge water power, water surface	655
of pond, water surface	655
elow Nixons Ford, water surface	659.5
n right bank, 1,400 feet below Nixons Ford	670.22
ll shoal at Nixons Ford, water surface	662.8
ace	663.2
ace	666.6
ace	670
sture, water surface	672.6
cCleskeys Branch, water surface	674.6
on right bank, McCleskeys Branch	692.35
eech Creek, water surface	674.6
ory on left bank, opposite Beech Creek	686.52
ulberry Fork, water surface	677.6
oo, 5 feet from left bank, opposite Mulberry Fork	686.51
n Bridge, water surface	678
er, one-half mile below Johnsons Mill, water surface	690
nsons milldam, water surface	690.7
nsons milldam, water surface	698
-bank iron pier, upstream truss, Johnsons Bridge	713.21
Bridge, water surface	699.7
ridge, water surface	701
cademy Branch, water surface	704.5
, Jefferson and Southern Railroad bridge, water surface	715.8
e of first bent, upstream, left bank, over Pond Fork	725.1

SURVEY OF APALACHEE RIVER.

y of Apalachee River was made in July and August, 3. High, under the direction of B. M. Hall, of the United gical Survey.

Elevations on Apalachee River from mouth to High Shoals.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0	Carey, water surface	43
1.5	Penicks Ferry, water surface	47.7
1.5	Penicks Ferry, sweet gum 50 feet from right bank	45.8
9.8	Below Reid's old dam, water surface	440.4
9.8	Above Reid's old dam, at mouth of Goose Creek, water surface	441.9
10.7	Reids Ferry Bridge, water surface	442
10.7	Reids Ferry Bridge, top of downstream iron pier, left bank	446.2
13.2	Mouth of Hard Labor Creek, water surface	444.4
13.2	Birch on right bank, 10 feet below mouth of Hard Labor Creek	446.7
16.3	Trimbles Bridge, water surface	452.4
16.3	Trimbles Bridge, large ash on island at center of bridge	455.8
21.8	Heads Bridge, top of upstream iron pier, right bank	500.2
21.8	Below Head's old milldam, water surface	477.3
21.8	Above Head's old milldam, water surface	480.4
21.9	Foot of Furlow Shoals, water surface	480.4
22.3	Base of rail, Central Railroad bridge	550.06
22.4	Top of Furlow Shoals, water surface	507.2
25.0	Mouth of Jacks Creek (river high from rain)	517.9
25.0	Large hickory on Jacks Creek, 50 feet from right bank of river	520.2
27.1	Foot of shoals, 1,000 feet below Price's mill, water surface	544.6
27.3	Above dam at Price's mill, water surface	564
27.3	Bench mark cut in large rock on right bank, 50 feet below dam	567.9
31.6	Below foot of shoal, water surface	596.7
31.8	Near bridge at High Shoals Factory, water surface	628.4
31.8	Top of projection of rock basement, southwest corner High Shoals Factory	631.44

SURVEY OF MULBERRY FORK OF OCONEE RIVER.

The survey of Mulberry Fork of Oconee River was made in July and August, 1902, by J. B. High, under the direction of B. M. Hall, of the United States Geological Survey.

Elevations on Mulberry Fork of Oconee River from mouth up to Hoschton.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0	Mouth of Mulberry Fork, water surface	677.8
0.3	Lower Mulberry Bridge, water surface	679.1
4.3	Hancocks Bridge, water surface	691
4.3	Hancocks Bridge, top of iron pile, right bank, downstream	702.9
9.8	Moons Bridge, water surface	707.5
12.8	Gainesville, Jefferson and Southern Railroad bridge, water surface	718.7
16.7	Mathis Bridge, water surface	735.5
18.6	Mulberry Forks, 2 miles from Hoschton, water surface	739.2
18.6	Root of large post oak, left bank, 25 feet below fork	743.7

WATER POWER IN ALTAMAHA RIVER DRAINAGE BASIN.

In the foregoing lists of water-surface elevations a complete statement of the fall and its distribution is given. The various points at which the surface elevations are shown are located by continued distances and reference to describable objects along the river. Records of the discharge at several hydrographic stations have been given, from which estimates of flow can be made for any point. To these is added a brief statement regarding the powers already developed, and some of the proposed grouping of the various shoals into proposed power developments.

WATER POWERS ON SOUTH RIVER.

From the Southern Railway bridge crossing South River near Constitution down to the head of Albert Shoals, a distance of 20 miles, the fall is about 100 feet. The stream is small, however, and only small amounts of power are obtainable. Flake's mill, about 13 miles from the beginning point, is the first power now utilized. At this place the dam is about 6 feet high and the working head, obtained by the use of a short canal, is about 11 feet.

At Flat Shoals, about 4 miles farther down the river, a new electric plant has been recently established. At Albert Shoals there is a fall of 16 feet in half a mile. This has been partly developed, but is not now used.

At Peachstone Shoals, 36 miles from the initial point, the power is developed by a low dam and a short canal, utilizing about 10 feet head, and operating Zackry's grist and cotton mill.

At Snapping Shoals, 7 miles below, the fall is 20 feet in 300 yards. This is partly utilized and operates De Loach's wood-working, flouring, and grist mills.

Three miles below is Island Shoals, where the fall is 10 feet in 250 yards and is partly developed at Haley's flour mill.

WATER POWERS ON OCMULGEE RIVER.

At the junction of Yellow and South rivers is the head of Barnes Shoals, where the fall is 9 feet in a short distance. A development here would have the additional water from Yellow River. Including the last-mentioned shoal, the fall is 14 feet from Yellow River down to Alcovy River.

Below Alcovy River down to the foot of Lloyds Shoals, 1 mile above Pittmans Ferry, the fall is 55 feet in a little less than 5 miles. The continuous shoals that make up this fall of 55 feet are known locally as Dotsons, Barnetts, Barnes, and Capps and Lloyds. The most precipitous part of this slope is the lower half, which has a fall of 43 feet in 2½ miles, and is known as Lloyds, or Capps and Lloyds, Shoals. Surveys have been made for a 60-foot development of this power, to back water to the foot of Barnes Shoals, near mouth of Yellow River, and to raise the water level 5 feet at the mouth of Alcovy River. This development can be made with a dam near foot of Lloyds Shoals, or as contemplated in the surveys mentioned, by a lower dam farther up, and a canal.

Smiths Shoals, extending from below Giles Ferry to Smith's mill, has a fall of 12 feet in 1½ miles. This is partly developed for Smith's mill by a low dam and a long, small canal.

The next power below is at Lamar's mill, a large merchant mill for

grinding corn and wheat. The fall here is about 20 feet in 1 mile. About 16 feet of the fall is partly developed by a wing dam and a short canal. If the dam were extended and raised 4 feet, the head would be 20 feet, without backing water on the next property above. The last three powers mentioned—Lloyd's, Smith's, and Lamar's—are above the Flovilla hydrographic station, located at Lamars Ferry.

The next power is at Juliette, where the fall is 15 feet in one-half mile. This is developed by a dam and a short canal, and operates the Glover Cotton Mills and the Juliette Milling Company's plant. From the tail water below the Glover mill to the mouth of Beaverdam Creek, below Holton, a distance of about 18 miles, there is a fall of about 60 feet. Macon capitalists have had surveys made for a proposed development of this fall, or a large portion of it.

WATER POWERS ON YELLOW RIVER.

Yellow River flows in a southeasterly direction, and joins South River, forming the Ocmulgee. It contains some valuable power sites, both developed and in a natural condition.

One-half mile above its mouth are the Indian Fishery Shoals, where there is a fall of 12 feet in about 200 feet. The river is here about 300 feet wide. A gristmill and a cotton gin in operation use perhaps nine-tenths of the available power.

For 13 miles above, the river runs between high banks, alternating with low bottoms without any marked shoals (except at Lees, where there is a fall of 2½ feet) to Langdons Shoals. The total fall in this 13 miles is 23 feet. Langdons Shoals has a 4-foot fall.

Three miles above, at Porterdale, is the finest power site on the river, where extensive developments have been made by the Bibb Manufacturing Company, which has a large cotton and twine factory at this point. Here there is a fall of 67 feet in one-half mile, with a 12-foot dam at the upper end of the shoal. The banks at the foot are very high, but gradually lower, until just above the dam large bottoms begin and continue for 5 miles. The water is backed up as far as the mouth of Hurricane Creek, 5 miles above.

The next power, McDaniels Shoals, has a 7-foot fall in a very short distance, and there is now a 6-foot dam operating a gristmill. At Milstead, Ga., 4½ miles above, there is a fall of 45 feet in one-half mile. This power has recently been developed and is used to operate a large cotton mill.

Eleven miles above is Annistown Shoals, with a 25-foot fall below the 11-foot dam, which formerly supplied storage for power used to operate a cotton mill. The banks here are all hard, unseamed rock, and the site could be developed into valuable property. Two and one-half miles above are some shoals with a 14-foot fall in half a mile.

Above this point the river flows through a very rough country, having a fall of about 36 feet in 6 miles, but passing no important shoals until the next power is reached at Yellow River, Ga., the end of the survey. Here is a dam 7.3 feet high, which operates the Simon roller mills.

WATER POWERS ON ALCOVY RIVER.

From the mouth of Alcovy River up to the foot of Whites Shoals, a distance of 9 miles, the fall is 25 feet. Whites Shoals and Newton Factory Shoals form one continuous series, with a fall of 83 feet in 1 mile. Here the river is in a gorge 300 feet wide, with banks over 100 feet high in several places. Near the middle of this shoal is an excellent site for a dam, from which a canal about one-half mile long would be required. At the upper end of the shoals is another good site for a dam, which would have a much greater storage basin, as just above the gorge widens a great deal and a large volume of water could be stored through the dry season. This development would require a canal for the entire length of the shoals. An old corn mill is in operation at this point, using a small wooden dam to divert the water into its flumes. Many years ago a large cotton factory stood on this site, but was burned and never rebuilt.

Six miles above these shoals are Henderson Shoals, with a fall of 2 feet. To obtain power for a gristmill, a 6-foot dam has been erected, the backwater from which extends to Dabneys Bridge, 4 miles above.

WATER POWERS ON TOWALIGA RIVER.

Towaliga River flows in a southeasterly direction and empties into Ocmulgee River. From its mouth up to the foot of High Falls, a distance of 21 miles, the fall is about 100 feet. The stream is narrow and swift, but has no marked shoals in this portion nor any favorable power sites. At High Shoals there is a fall of 95 feet in a distance of 1,000 yards, in the middle of which there is a sudden drop of 42 feet, known as High Falls. This is an excellent power site, for, although the low-water flow is small, there is a good basin above for storage. This power has been recently developed and an electric plant installed.

WATER POWERS ON OCONEE RIVER AND TRIBUTARIES.

At Milledgeville a large mill for grinding wheat and corn is operated by water power, the development for which is a low dam across Oconee River and a canal along the west bank about one-half mile long.

At the foot of Furmans Shoals, about 4 miles above Milledgeville, begins a very fine water power. The fall here is 41 feet up to the

mouth of Little River, 7 miles above, about 30 feet of the fall being in half the distance. Extensive surveys for the development of the power have been made, and more recently it is proposed to develop about 50 feet of head, backing water above the mouth of Little River.

From the mouth of Little River to the foot of Laurens Shoals, a distance of 19 miles, the fall is 56 feet, and is almost uniformly distributed.

At Laurens Shoals the fall is 31 feet in 3½ miles. Immediately above, at Rileys or Methodist Fishery Shoals, the fall is 30 feet in three-fourths mile, and continuing up the river, the fall is 15 feet in the next 1½ miles, to top of Long Shoals.

The last three shoals have a total fall of 77 feet from the foot of Laurens Shoals to the head of Long Shoals, a distance of 6¼ miles.

At Park's mill, 3½ miles below the mouth of Apalachee River, the working head is 10 feet, developed by a dam of that height. In the 22 miles above Park's mill to foot of Scull Shoals the fall is only 25 feet. At Scull Shoals the fall is about 6 feet in several miles length.

At Barnetts Shoals there is a fine water power, the fall being 51 feet in a distance of 2¼ miles. About 3 miles above is the junction of North Oconee and Middle Oconee rivers. On each of these streams there are several developed water powers in the vicinity of Athens.

MINOR ATLANTIC DRAINAGE BASINS.

SATILLA RIVER DRAINAGE BASIN.

MISCELLANEOUS MEASUREMENTS.

Satilla River.—A measurement was made September 9, 1904, at the covered wagon bridge, 3 miles east of Waycross. The bench mark is the center of lag bolt driven into the left side of the first floor beam from the first pier from the left bank, 20.00 feet above the datum of the gage.

Width, 108 feet; area, 1,077 square feet; mean velocity, 1.07 feet per second; gage height, 8.2 feet; discharge, 1,150 second-feet.

Hurricane Creek.—This stream is an important tributary of Satilla River, entering from the north. A measurement was made on it on September 10, 1904, at Baxley's bridge, near Blackshear. The bench mark is a large nail driven into the downstream end of the floor beam over the second pier from the right bank, 15.00 feet above the datum of the gage.

Width, 67 feet; area, 415 square feet; mean velocity, 1.35 feet per second; gage height, 6.57 feet; discharge, 562 second-feet.

APALACHICOLA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The rivers flowing into the eastern portion of the Gulf of Mexico are for the most part similar in character to those in the Southern Atlantic drainage, though in their lower courses their flow is usually more sluggish.

Apalachicola River is formed by the union of Flint and Chattahoochee rivers at the Georgia-Florida line and flows in a southerly direction through Florida to the Gulf of Mexico. It is navigable, and boats run up Flint River to Albany and up the Chattahoochee River to Columbus.

Flint River rises a few miles south of Atlanta, in Fulton County, and flows in a southerly direction to Talbot County, southeasterly to Macon County, southerly to Worth County, and southwesterly to Apalachicola River. It drains the south-central portion of Georgia, extending from Atlanta south to the Florida line. Its tributaries are mainly large creeks with much fall. The principal ones among these are Whitewater, Redoak, Big Potato, Muckalee, Kinchafoonee, Ichawaynochaway, and Spring creeks.

Flint River has many good water powers on its course. Between Woodbury and Knoxville, Crawford County, a distance of about 45 miles, the river falls 334 feet. Very little of its power is yet developed.

Chattahoochee River rises in the Blue Ridge, in White County, and flows in a southwesterly direction until it reaches the Alabama line at the southwest corner of Troup County. From there it flows in a southerly direction, forming the western boundary of Georgia, until it flows into Apalachicola River at the southern boundary of the State. It drains almost all of the north-central, middle-west, and southwest portions of Georgia, and has a drainage area of 4,900 square miles at Columbus, which is at the fall line.

Soque River joins the Chattahoochee on the western edge of Habersham County. This river rises in Habersham County and flows in a southwesterly direction. It has considerable fall, dropping as much as 40 feet within a few hundred feet.

Farther down the Chattahoochee, at the west boundary of Hall County, Chestatee River enters. It rises in Lumpkin County and flows in a southerly direction through a very hilly and steep country and has much fall all along its course.

From its source down to Columbus the Chattahoochee River is an excellent water-power stream. From the lower edge of Lumpkin County down to Columbus, Ga., there is a fall of over 850 feet, 366 feet of this fall being between West Point and Columbus. All along its course there are many small tributaries flowing from a high, hilly country. These have much fall, and many small water powers are available.

STREAM FLOW.

CHATTAHOOCHEE RIVER NEAR CORNELIA.

This station was established as a bench-mark station. It is located at Duncan Bridge, about 7 miles northwest of Cornelia, Ga., and 1 mile below the mouth of Soque River. Discharge measurements are made from the downstream side of the inclosed wooden highway bridge, the meter being lowered through holes cut in the floor or by raising a plank. The initial point for soundings is the end of the bridge at the left bank, downstream side. The channel is curved for about 500 feet above and straight for about 800 feet below the station. The current is moderate. The right bank is clean, and overflows for about 200 feet. The left bank is high, rocky, wooded, and does not overflow. The bed of the stream is composed of rock at the left and silt at the right bank, free from vegetation, and shifting. There is but one channel at all stages, broken by the piers of the bridge. A fish-trap dam about 800 feet below the bridge will probably affect the rating at this station. The bench mark is the top of downstream stringer at a point 59 feet from the left end of the bridge; elevation, 21.00 feet above datum.

Discharge measurements of Chattahoochee River near Cornelia, Ga.

Date.	Gage height.	Discharge.
1904.	*Feet.*	*Second-feet.*
June 8	1.40	67
September 30	.95	25
October 29	.91	23

CHATTAHOOCHEE RIVER NEAR GAINESVILLE.

This station was established on June 26, 1901, 3½ miles northwest of Gainesville, at Thompson's bridge and was discontinued December 31, 1903.

The channel is slightly curved for 1,000 feet above and below the station. The bed is of sand and is very changeable. The bridge from which discharge measurements were made is a three-span wooden structure supported on stone piers. At low water nearly the whole of the river flows through the center span, which is 100 feet long. It is entirely housed in, but holes are cut in the floor along the upstream side at intervals of 12 feet, through which the meter can be lowered for gaging. The initial point for soundings is the end of the bridge on the left-bank upstream side.

The gage as originally established was a 15-foot vertical rod, on the right bank about 50 feet below the bridge. A standard chain gage is attached to a beam on the upstream side of the bridge about 160 feet from the initial point for soundings; length of the chain from the end

to marker, 34.68 feet. The observer was Jack Elrod. Bench mark No. 1 is the top of the downstream wooden stringer supporting the bridge floor, about 2 feet to the left of the first stone pier on the left bank; elevation, 31.00 feet above gage datum. Bench mark No. 2 is a copper plug set in solid rock on the hill about 50 feet from the river and 115 feet downstream from the bridge on the right bank; elevation, 42.73 feet above gage datum.

Discharge measurements of Chattahoochee River near Gainesville.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1903.	*Feet.*	*Sec.-ft.*
July 16	5.73	2,777	January 10	3.09	958
October 25	3.00	993	March 28	5.43	2,670
			April 24	4.80	2,248
1902.			May 4	4.87	2,234
February 7	3.65	1,482	June 25	3.40	1,519
May 3	3.80	1,241	August 1	3.16	1,052
July 11	2.58	704	August 29	2.52	677
October 11	2.80	715	September 25	2.43	728
November 24	2.33	520	December 9	2.22	531

Daily gage height, in feet, of Chattahoochee River near Gainesville.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
1							3.8	2.8	5.1	4.0	3.0	2.3
2							3.6	2.8	5.0	3.9	3.0	2.3
3							3.5	2.8	4.6	3.7	2.9	2.3
4							3.4	2.7	4.5	3.5	2.9	2.4
5							3.2	12.0	4.1	4.0	2.9	2.4
6							3.3	8.5	4.0	4.1	3.0	2.4
7							3.2	5.2	3.9	4.0	3.0	2.6
8							3.4	5.0	3.7	4.0	2.8	2.8
9							3.2	3.2	4.1	3.9	2.8	3.6
10							3.2	4.8	4.0	3.9	2.8	4.6
11							3.1	4.8	5.5	3.7	2.8	4.3
12							3.0	2.9	5.5	3.8	2.7	4.1
13							3.0	3.6	4.2	3.6	2.7	4.0
14							3.1	3.2	3.8	3.5	2.7	4.0
15							3.1	2.8	3.5	3.6	2.6	3.9
16							6.5	5.6	3.9	3.5	2.6	3.4
17							4.5	6.8	11.0	3.4	2.5	3.8
18							5.5	5.8	6.0	3.4	2.5	3.6
19							8.6	3.5	4.6	3.4	2.4	3.7
20							5.9	4.8	4.2	3.4	2.8	3.9
21							5.0	6.5	3.8	3.3	2.7	4.6
22							4.9	12.0	3.4	3.3	2.5	4.2
23							3.8	15.0	3.2	3.2	2.5	4.0
24							3.1	6.5	3.8	3.0	2.8	4.6
25							3.0	5.6	3.7	3.1	2.7	4.4
26						4.0	2.8	6.0	3.5	3.1	2.5	4.2
27						8.6	3.2	5.0	4.0	3.1	2.4	5.6
28						5.1	3.0	5.5	3.8	3.1	2.4	9.6
29						4.2	3.1	7.0	3.9	3.1	2.3	28.4
30						5.6	2.8	6.5	3.8	3.0	2.2	12.6
31							3.0	6.0		3.0		8.4
1902.												
1	8.0	4.9	14.0	5.5	3.1	3.5	2.3	3.1	4.2			
2	6.4	15.6	6.0	5.3	3.4	3.4	2.0	3.0	4.0			
3	6.3	10.4	5.9	5.0	4.6	3.2	7.9	4.2	4.5			
4	6.0	9.3	5.6	4.6	4.5	3.0	6.3	3.6	4.5			
5	5.6	6.1	5.0	4.2	4.2	3.0	4.2	2.8	4.6			

Daily gage height, in feet, of Chattahoochee River near Gainesville—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
6	4.2	5.0	4.9	4.0	4.0	2.9	4.2	2.6	4.8			
7	3.6	4.1	4.8	3.9	4.6	2.9	4.0	3.0	4.5			
8	3.4	4.0	6.8	3.9	4.8	2.8	4.0	2.8	4.3			
9	3.4	3.9	5.6	3.6	4.3	2.8	3.8	3.1	4.9			
10	3.4	3.8	5.3	3.4	5.0	3.0	3.6	4.0	4.6			
11	3.3	3.6	5.0	3.4	4.9	3.0	3.5	4.6	4.8			
12	3.2	3.5	4.8	3.4	4.6	2.9	3.2	4.0	4.6			
13	3.2	3.6	4.6	3.3	4.3	2.9	3.0	3.6	4.5			
14	3.1	3.5	4.2	3.2	4.0	2.8	4.0	3.6	4.2			
15	3.0	3.3	4.6	3.1	4.0	2.8	3.8	3.6	4.6			
16	3.0	3.2	6.3	3.2	4.0	2.9	2.9	3.1	4.8			
17	2.9	3.1	5.6	3.8	4.0	3.0	4.6	3.6	4.0			
18	2.8	3.2	4.3	3.9	4.0	4.0	4.0	3.1	4.2			
19	2.8	3.3	4.2	3.5	4.1	3.8	3.6	3.6	4.6			
20	2.7	3.4	4.0	3.6	4.0	3.6	3.5	2.8	4.8			
21	2.6	3.0	4.0	3.4	3.9	4.2	3.4	2.8	4.6			
22	2.6	3.0	3.9	3.2	3.4	4.0	4.2	3.1	4.8			
23	2.6	2.9	3.8	3.8	6.0	4.0	3.6	4.0	4.0			
24	3.6	2.9	3.6	3.6	5.3	3.8	4.0	4.6	3.6			
25	3.8	2.9	3.6	3.4	5.0	3.4	3.1	4.0	3.7			
26	3.8	3.0	3.5	3.4	4.8	3.4	2.6	4.6	4.0			
27	3.7	6.0	7.6	3.4	4.6	3.4	2.5	4.0	4.6			
28	3.6	26.4	15.6	3.5	4.3	2.8	3.0	3.6				4.0
29	3.6		18.4	3.4	4.0	2.8	4.0	4.2				4.1
30	3.5		10.6	3.2	3.6	2.4	3.4	4.2				4.6
31	4.6		6.4		3.5		2.8	4.6				3.7
1903.												
1	3.5	3.5	8.0	6.1	4.6	7.0	3.6	3.0	2.6	2.4	2.2	2.1
2	3.4	3.7	6.0	5.7	4.5	13.2	3.6	3.1	2.6	2.3	2.3	2.1
3	3.7	4.4	4.6	5.5	4.7	9.0	3.5	3.2	2.6	2.3	2.5	2.1
4	4.2	7.4	4.2	5.4	4.8	6.5	3.5	3.2	2.6	2.3	2.6	2.1
5	3.9	6.0	4.0	5.3	4.4	10.6	3.5	3.1	2.6	2.3	2.7	2.1
6	3.6	4.5	5.1	5.1	4.2	6.2	3.8	3.1	2.6	2.3	2.7	2.2
7	3.4	4.9	4.7	5.0	4.2	5.9	3.4	3.0	2.6	2.3	2.6	2.2
8	3.4	11.2	5.7	8.6	4.2	5.8	3.4	3.0	2.6	2.3	2.3	2.2
9	3.2	6.4	5.4	5.7	4.2	5.4	3.4	2.9	2.6	2.4	2.3	2.2
10	3.1	5.3	6.0	5.5	4.1	5.1	3.4	2.8	2.6	2.4	2.3	2.2
11	6.0	12.1	12.9	5.4	4.0	5.0	3.7	4.1	2.6	2.3	2.3	2.2
12	5.4	8.7	7.0	5.1	3.9	4.3	6.3	2.9	2.6	2.2	2.4	2.2
13	4.1	5.4	6.0	15.8	4.0	4.0	4.5	3.2	2.6	2.2	2.4	2.5
14	3.7	5.0	5.1	9.7	4.3	4.0	3.7	3.3	2.6	2.2	2.4	2.6
15	3.6	4.2	5.0	6.6	4.1	3.9	3.5	4.1	6.0	2.2	2.3	2.3
16	3.5	9.9	4.9	5.8	4.0	3.9	3.4	7.5	4.7	2.2	2.2	2.2
17	3.5	15.6	4.7	5.5	4.0	3.8	3.4	5.8	3.9	2.2	2.4	2.2
18	3.4	7.1	4.5	5.3	4.0	3.8	3.2	5.0	3.1	2.2	3.1	2.2
19	3.3	5.4	4.4	5.5	4.0	3.8	3.1	3.5	2.8	2.2	2.8	2.2
20	3.2	5.0	4.1	5.4	3.9	3.8	3.1	5.0	2.6	2.2	2.3	2.6
21	3.2	4.7	7.7	5.1	3.9	3.7	3.1	3.2	2.6	2.2	2.3	2.6
22	3.2	4.5	10.5	5.0	3.8	3.7	3.1	3.0	2.6	2.2	2.3	2.5
23	3.2	4.2	25.2	4.8	3.8	3.6	3.0	2.9	2.6	2.1	2.3	2.3
24	3.2	4.0	9.4	4.8	3.8	3.6	3.0	2.8	2.6	2.1	2.3	2.3
25	3.1	3.8	7.0	4.8	3.7	3.5	3.0	2.8	2.5	2.1	2.2	2.4
26	3.1	3.8	6.3	4.8	3.7	3.7	3.0	2.7	2.5	2.1	2.2	2.4
27	3.1	5.6	5.9	4.7	3.7	4.5	2.9	2.7	2.5	2.1	2.2	2.3
28	3.7	14.5	5.5	4.7	3.6	4.0	2.9	2.6	2.4	2.1	2.2	2.3
29	5.5		6.9	4.6	3.6	3.8	2.9	2.6	2.4	2.1	2.2	2.3
30	4.0		12.2	4.6	3.7	3.7	2.9	2.6	2.4	2.1	2.2	2.3
31	3.7		8.2		5.4		3.2	2.6		2.1		2.3

ting table for Chattahoochee River near Gainesville from June 26, 1901, to December 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	350	3.90	1,585	6.60	3,340	12.00	6,850
2.10	415	4.00	1,650	6.80	3,470	13.00	7,500
2.20	480	4.10	1,715	7.00	3,600	14.00	8,150
2.30	545	4.20	1,780	7.20	3,730	15.00	8,800
2.40	610	4.30	1,845	7.40	3,860	16.00	9,450
2.50	675	4.40	1,910	7.60	3,990	17.00	10,100
2.60	740	4.50	1,975	7.80	4,120	18.00	10,750
2.70	805	4.60	2,040	8.00	4,250	19.00	11,400
2.80	870	4.70	2,105	8.20	4,380	20.00	12,050
2.90	935	4.80	2,170	8.40	4,510	21.00	12,700
3.00	1,000	4.90	2,235	8.60	4,640	22.00	13,350
3.10	1,065	5.00	2,300	8.80	4,770	23.00	14,000
3.20	1,130	5.20	2,430	9.00	4,900	24.00	14,650
3.30	1,195	5.40	2,560	9.20	5,030	25.00	15,300
3.40	1,260	5.60	2,690	9.40	5,160	26.00	15,950
3.50	1,325	5.80	2,820	9.60	5,290	27.00	16,600
3.60	1,390	6.00	2,950	9.80	5,420	28.00	17,250
3.70	1,455	6.20	3,080	10.00	5,550		
3.80	1,520	6.40	3,210	11.00	6,200		

[a] This rating table is based on a tangent, the difference being 65 per tenth.

Estimated monthly discharge of Chattahoochee River near Gainesville.

[Drainage area, 544 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.					
ıe 26–30	2,690	1,390	1,975	3.63	0.68
y	4,640	870	1,520	2.79	3.22
gust	8,800	805	2,724	5.01	5.78
tember	6,200	1,130	1,912	3.51	3.92
ober	1,715	1,000	1,327	2.44	2.81
vember	1,000	480	792	1.46	1.63
ember	17,510	545	2,342	4.31	4.97
1902.					
ıuary	4,250	740	1,530	2.81	3.24
ruary	16,210	935	2,553	4.69	4.88
rch	11,010	1,325	3,086	5.67	6.54
ril	2,625	1,065	1,479	2.72	3.03
y	2,950	1,065	1,835	3.37	3.89
ıe	1,780	610	1,139	2.09	2.33
y	4,185	350	1,461	2.69	3.10
gust	2,040	740	1,388	2.55	2.94
tember 1–27	2,235	1,390	1,922	3.53	3.55
ember 28–31	1,650	1,455	1,552	2.85	.42
1903.					
ıuary	2,950	1,065	1,442	2.65	3.06
ruary	9,190	1,325	3,247	5.97	6.22
rch	15,430	1,650	3,602	6.62	7.63
ril	9,320	2,040	2,861	5.26	5.87
y	2,560	1,390	1,709	3.14	3.62
ıe	7,630	1,325	2,361	4.34	4.84
y	3,145	935	1,273	2.34	2.70
gust	3,925	740	1,258	2.31	2.66
tember	2,950	610	883	1.62	1.81
ober	740	415	497	.91	1.05
vember	1,065	480	599	1.10	1.23
ember	740	415	535	.98	1.13
The year	15,430	415	1,689	3.10	41.82

CHATTAHOOCHEE RIVER NEAR BUFORD.

This station was established June 24, 1901, at Stricklands Bridge about 6 miles southwest of Buford. Discharge measurements are made from the upstream side of the bridge, which is a single-span iron highway bridge, about 200 feet in length. The wire gage is fastened to the upstream guard timber on bridge floor. The bench mark is the top of the bridge floor, over the upstream end of the second crossbeam from the left bank; elevation, 33.00 feet above gage datum. This station was discontinued December 31, 1901.

Discharge measurements of Chattahoochee River near Buford.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1901.	*Feet.*	*Sec.-ft.*
April 12	3.40	2,310	August 6	6.90	[illegible]
June 14	3.47	2,559	October 24	2.46	[illegible]
July 17	5.38	3,893			

Daily gage height, in feet, of Chattahoochee River near Buford.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	De
1901.							
1		3.9	2.4	5.5	5.4	2.3	[illegible]
2		3.7	2.2	4.8	4.3	2.3	[illegible]
3		3.4	2.1	4.5	3.1	2.3	[illegible]
4		3.2	2.1	4.2	3.0	2.3	[illegible]
5		3.0	2.2	4.0	2.9	2.4	[illegible]
6		2.9	2.1	3.9	2.8	2.4	[illegible]
7		3.1	3.3	3.8	2.8	2.3	[illegible]
8		3.7	4.9	3.7	2.8	2.3	[illegible]
9		3.2	3.4	3.5	2.8	2.2	[illegible]
10		2.8	3.1	3.5	2.8	2.2	[illegible]
11		2.7	3.5	4.1	2.8	2.2	[illegible]
12		2.5	3.4	3.9	2.7	2.2	[illegible]
13		2.6	3.3	3.5	3.1	2.4	[illegible]
14		2.6	3.3	3.5	2.8	2.3	[illegible]
15		2.8	7.9	3.4	2.7	2.2	[illegible]
16		2.6	7.4	3.3	2.7	2.2	[illegible]
17		9.7	7.2	5.1	2.6	2.1	[illegible]
18		3.3	9.0	11.0	2.5	2.1	[illegible]
19		8.9	7.6	5.3	2.4	2.2	[illegible]
20		4.5	7.4	4.2	2.5	2.3	[illegible]
21		3.4	11.0	3.9	2.5	2.3	[illegible]
22		3.3	12.0	3.7	2.5	2.2	[illegible]
23		3.0	18.0	3.5	2.5	2.2	[illegible]
24		2.8	9.2	3.5	2.4	2.5	[illegible]
25		2.6	7.5	3.3	2.4	2.3	[illegible]
26		2.5	6.0	3.3	2.4	2.3	[illegible]
27		2.6	6.2	3.3	2.4	2.2	[illegible]
28		2.7	5.9	3.3	2.4	2.1	[illegible]
29		3.3	8.2	3.8	2.4	2.2	[illegible]
30		2.8	7.3	3.5	2.3	2.2	[illegible]
31		2.5	6.0		2.4		[illegible]

ting table for Chattahoochee River near Buford from June 24 to December 31, 1901.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	1,450	3.80	2,700	5.50	4,200	8.40	7,312
2.20	1,500	3.90	2,780	5.60	4,300	8.60	7,536
2.30	1,560	4.00	2,860	5.70	4,400	8.80	7,760
2.40	1,630	4.10	2,940	5.80	4,500	9.00	7,984
2.50	1,700	4.20	3,020	5.90	4,600	9.20	8,208
2.60	1,775	4.30	3,105	6.00	4,700	9.40	8,432
2.70	1,850	4.40	3,190	6.20	4,900	9.60	8,656
2.80	1,925	4.50	3,275	6.40	5,100	9.80	8,880
2.90	2,000	4.60	3,360	6.60	5,300	10.00	9,104
3.00	2,075	4.70	3,445	6.80	5,520	10.50	9,664
3.10	2,150	4.80	3,530	7.00	5,744	11.00	10,224
3.20	2,225	4.90	3,620	7.20	5,968	12.00	11,344
3.30	2,305	5.00	3,710	7.40	6,192	13.00	12,464
3.40	2,380	5.10	3,800	7.60	6,416	14.00	13,584
3.50	2,460	5.20	3,900	7.80	6,640	15.00	14,704
3.60	2,540	5.30	4,000	8.00	6,864	22.50	23,100
3.70	2,620	5.40	4,100	8.20	7,088		

[a] Above gage height 7.0 feet the rating curve is a tangent, the difference being 112 per tenth.

Estimated monthly discharge of Chattahoochee River near Buford.

[Drainage area, 1,050 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.					
24-30	5,520	2,460	3,554	3.38	0.88
	8,768	1,700	2,507	2.39	2.76
st	18,064	1,450	4,985	4.75	5.48
mber	10,224	2,300	3,031	2.89	3.22
ber	3,105	1,560	1,863	1.77	2.04
mber	1,630	1,450	1,537	1.46	1.63
mber	23,100	1,450	3,624	3.45	3.98

CHATTAHOOCHEE RIVER NEAR NORCROSS.

his station was established June 10, 1902, by M. R. Hall. It is ted at Medlock's toll bridge, about 4½ miles north of Norcross. s point is above the mouth of Johns Creek and below the mouth uwanee Creek.

he channel is slightly curved for 600 feet above and 700 feet below station. The current is sluggish at low stages, but not excess- y so, and the discharge measurements are considered good at the est stage. The right bank is high and will overflow only for 50 from the water's edge; the left bank will overflow for about 800 at a gage height of from 16 to 18 feet. The bed of the stream is ly and probably changes.

Discharge measurements are made from the downstream side of single-span bridge and its approaches. The initial point for ndings is 50 feet to the right of the center of the downstream ular pier on the right bank.

The original gage was a vertical staff attached to an oak tree on right bank 100 feet above the bridge. A chain gage, established rch 14, 1903, was read in connection with the vertical gage until

June 28, 1905, when a standard chain gage was attached to downstream lower chord of the first panel from the right b length of chain, 30.36 feet. The gage is read twice each day W. O. Medlock. The bench mark is the top of the iron pier on right bank, downstream side; elevation, 27.00 feet.

Discharge measurements of Chattahoochee River near Norcross.

Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*
January 9	2.70	1,837
March 14	5.35	4,940
May 5	4.08	3,543
May 29	3.15	2,378
June 26	3.13	2,447
July 17	3.06	2,254
July 17	3.06	2,255
August 19	3.15	2,337
August 19	3.05	2,288
August 19	3.15	2,281
August 19	3.05	2,203
September 26	2.06	1,197
October 23	1.94	1,078
November 25[a]	1.95	1,062
November 25	1.95	1,071
1904.		
January 19	2.19	1,419
January 19	2.19	1,362
February 20	3.45	2,607
April 7	2.50	1,496
June 7	2.54	1,571
June 20	1.53	662
August 9	8.62	9,938

Date.	Gage height.	Di
1904.	*Feet.*	
August 9	6.57	
August 10	3.60	
September 28	1.22	
September 28	1.22	
October 11	1.32	
October 14	1.28	
December 9	1.88	
1905.		
January 13	12.26	
January 13	12.10	
January 13	11.82	
January 14	5.29	
January 14	5.05	
March 2	2.94	
May 27	3.19	
May 27	3.16	
June 28	2.01	
September 22	1.51	
September 22	1.52	
October 28	1.90	
October 28	1.92	
October 28	1.90	
December 9	8.56	

[a] Measurement taken at Warsaw Ferry, 1 mile above bridge.

Daily gage height, in feet, of Chattahoochee River near Norcross.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1903.											
1		2.9	14.1	7.0	4.0	4.5	3.2	3.1	2.1	2.0	1.9
2		2.8	7.0	6.0	4.0	9.7	3.1	2.6	2.0	2.0	2.0
3		3.2	5.6	5.5	4.0	7.5	3.3	6.1	2.0	2.0	2.7
4		5.2	5.0	5.4	4.2	4.9	3.2	3.6	2.0	2.0	2.3
5		8.3	4.7	5.1	4.1	9.7	3.1	3.2	2.2	2.0	2.4
6		4.9	4.8	4.8	3.9	11.2	3.0	2.8	2.1	2.0	2.7
7		4.3	4.6	4.7	3.8	7.3	3.5	2.6	2.0	2.0	2.2
8		10.6	4.8	5.8	3.8	5.5	3.1	2.5	2.0	2.0	2.1
9	2.7	8.6	5.3	7.9	3.8	4.7	3.3	2.4	2.3	2.2	2.6
10	2.6	5.2	5.0	5.4	3.7	4.4	2.9	2.4	2.2	2.2	2.0
11	2.7	6.4	8.7	5.0	3.6	5.1	3.2	2.4	2.1	2.0	2.0
12	5.8	11.1	11.5	4.8	3.6	4.9	3.3	2.7	2.0	2.0	2.1
13	4.2	6.2	6.4	4.7	3.7	4.1	6.8	2.5	2.0	1.9	2.0
14	3.4	4.9	5.5	12.6	3.8	3.9	4.6	2.5	1.9	1.9	2.0
15	3.2	4.8	5.1	7.8	3.9	3.7	3.6	3.2	3.6	1.9	2.0
16	3.0	4.5	4.8	5.9	3.7	3.6	3.2	3.2	4.9	1.9	2.0
17	2.9	14.9	4.6	5.4	3.6	3.5	3.0	4.3	3.6	2.0	2.0
18	2.8	13.7	4.5	5.1	3.5	3.5	3.0	5.0	2.8	2.2	2.3
19	2.7	5.9	4.3	4.9	3.4	3.5	2.9	3.5	2.4	2.2	2.5
20	2.6	5.1	4.2	4.8	3.4	3.4	2.8	2.7	2.3	2.0	2.1
21	2.6	4.7	5.9	4.9	3.4	3.3	2.8	2.6	2.2	2.0	2.0
22	2.7	4.4	8.0	4.6	3.4	3.3	2.7	2.5	2.2	2.0	2.0
23	2.6	4.2	16.7	4.5	3.3	3.2	2.7	2.4	2.1	1.9	2.0
24	2.5	4.0	19.4	4.4	3.2	3.2	2.6	2.3	2.1	1.9	2.0
25	2.7	3.9	9.0	4.3	3.2	3.1	2.6	2.3	2.1	1.9	2.0
26	2.7	3.8	6.4	4.4	3.1	3.1	2.5	2.2	2.1	1.9	2.0
27	2.6	3.7	5.8	4.4	3.1	4.0	2.5	2.2	2.1	1.9	1.9
28	2.7	3.6	5.5	4.2	3.1	3.8	2.5	2.1	2.1	1.9	1.9
29	3.6		5.4	4.1	3.1	3.7	2.5	2.1	2.0	1.9	1.9
30	4.0		10.0	4.0	3.5	3.5	2.5	2.1	2.0	1.9	1.9
31	3.2		11.4		5.2		2.6	2.3		1.9	

Daily gage height, in feet, of Chattahoochee River near Norcross—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
.....	1.9	2.2	2.5	2.55	2.3	2.4	1.7	2.65	1.8	1.35	1.25	1.5
.....	1.9	2.1	2.6	2.55	2.25	2.3	1.55	2.7	1.75	1.3	1.3	1.35
.....	2.0	2.1	2.6	2.5	2.2	2.3	1.5	2.35	1.7	1.35	1.35	1.4
.....	1.9	2.1	2.4	2.4	2.5	2.1	1.45	2.2	1.9	1.2	1.5	1.55
.....	1.9	2.1	2.3	2.35	2.4	1.95	1.7	3.1	2.4	1.15	1.65	2.0
.....	1.8	2.1	2.3	2.35	2.3	1.9	1.55	2.55	2.1	1.25	1.6	3.45
.....	1.8	2.3	4.7	2.5	2.2	2.65	1.5	2.15	2.05	1.3	1.5	2.85
.....	2.0	3.0	6.0	3.2	3.6	2.3	1.5	7.7	1.8	1.3	1.45	2.1
.....	1.9	2.9	3.9	3.4	4.05	2.05	1.3	8.2	1.7	1.3	1.4	1.9
.....	1.9	2.7	3.3	3.7	3.6	1.9	1.3	3.7	1.8	1.15	1.4	1.9
.....	1.9	2.7	3.0	3.0	2.8	1.8	1.55	4.5	1.65	1.25	1.4	1.9
.....	2.0	2.7	2.85	2.8	2.55	1.9	1.75	3.95	1.55	1.1	1.4	1.8
.....	2.0	2.5	2.7	2.7	2.4	1.8	1.85	2.85	1.6	1.3	1.6	1.7
.....	2.1	2.3	3.2	2.6	2.35	1.8	1.9	2.55	1.55	1.3	1.65	1.7
.....	2.1	2.3	3.1	2.5	2.35	1.7	1.6	2.4	1.5	1.2	1.6	1.65
.....	2.0	2.3	2.75	2.5	2.25	1.7	1.6	2.5	1.45	1.25	1.5	1.65
.....	2.2	2.2	2.6	2.55	2.2	1.7	1.85	2.15	1.45	1.25	1.5	1.7
.....	2.5	2.1	2.55	2.5	2.2	1.65	1.5	2.0	1.45	1.15	1.45	1.7
.....	2.2	2.3	2.5	2.45	2.15	1.2	1.65	1.9	1.4	1.1	1.45	1.6
.....	2.1	3.5	2.45	2.4	2.15	1.6	1.4	2.0	1.4	1.1	1.45	1.6
.....	2.0	3.6	2.6	2.4	2.1	1.5	1.7	2.2	1.4	1.1	1.4	1.6
.....	2.8	4.9	3.0	2.4	2.1	1.45	1.85	1.85	1.4	1.25	1.55	1.6
.....	3.1	5.3	3.4	2.4	2.05	1.35	2.05	1.7	1.4	1.25	1.8	1.55
.....	3.3	4.0	3.6	2.35	2.0	1.25	1.7	1.8	1.45	1.2	1.85	1.55
.....	2.6	3.3	3.5	2.3	2.0	1.2	1.6	2.05	1.4	1.2	1.65	1.7
.....	2.4	2.9	3.2	2.3	2.0	1.2	1.8	2.0	1.3	1.25	1.55	1.85
.....	2.3	2.8	3.0	2.45	1.95	1.4	1.8	2.4	1.2	1.3	1.5	1.95
.....	2.2	2.6	2.9	2.5	1.9	1.95	1.6	2.8	1.2	1.2	1.45	3.8
.....	2.2	2.6	2.75	2.35	1.9	2.3	1.7	2.45	1.25	1.1	1.45	3.55
.....	2.2	.....	2.65	2.3	2.0	2.4	2.1	2.05	1.4	1.3	1.5	2.5
.....	2.2	.....	2.6	.....	2.5	.....	1.9	1.9	.....	1.3	.....	2.2
1905.[a]												
.....	2.0	2.15	3.0	2.4	2.65	2.5	10.5	2.0	1.8	1.72	1.72	1.48
.....	1.98	2.1	2.95	2.35	2.4	2.4	6.1	1.95	2.15	1.82	1.7	1.6
.....	2.0	2.05	2.85	2.3	2.6	2.35	3.3	1.9	2.25	1.68	1.68	8.4
.....	1.93	2.05	2.8	2.35	3.3	2.3	2.7	1.85	1.95	1.72	1.68	7.6
.....	1.83	2.0	2.7	2.45	3.0	2.25	3.2	1.9	1.85	1.95	1.65	3.6
.....	2.02	2.2	2.65	2.6	3.1	2.2	3.8	1.85	1.8	1.72	1.68	2.9
.....	3.15	2.95	2.65	2.6	5.3	2.2	4.2	1.9	1.75	1.6	1.82	2.65
.....	2.9	3.3	2.7	2.45	4.5	2.1	3.2	2.3	1.72	1.55	2.2	2.85
.....	2.35	5.1	2.7	2.5	4.6	2.1	2.85	2.6	1.73	1.5	1.92	7.2
.....	2.2	6.7	2.9	2.5	3.5	2.05	3.7	2.7	1.7	1.58	2.1	8.1
.....	2.2	5.1	3.3	2.4	3.0	2.0	5.2	3.6	1.68	2.7	1.88	4.4
.....	6.5	4.3	3.1	2.4	2.8	2.0	7.4	3.8	1.9	3.5	1.25	3.4
.....	11.9	7.7	2.9	2.6	2.7	2.3	6.0	4.2	1.75	2.2	1.2	3.0
.....	5.3	6.7	2.8	2.5	2.6	2.1	4.0	3.6	1.72	1.9	1.25	2.85
.....	3.7	4.3	2.8	2.4	2.5	2.1	4.2	3.8	1.63	1.82	2.15	2.95
.....	3.1	3.6	2.7	2.6	3.9	2.35	3.6	2.9	1.6	1.82	1.92	3.1
.....	2.8	3.3	2.6	2.45	4.0	2.45	2.9	2.65	1.6	1.88	1.98	2.9
.....	2.65	3.1	2.55	2.35	3.1	2.3	2.8	2.4	1.6	1.78	1.82	2.75
.....	2.55	2.95	2.55	2.3	2.8	2.15	2.6	2.3	1.6	1.75	1.75	2.6
.....	2.55	4.1	2.55	2.3	2.7	2.1	2.5	2.25	1.6	1.75	1.75	3.2
.....	2.5	11.5	2.65	2.3	2.6	2.6	2.7	2.2	1.55	1.7	1.95	5.8
.....	2.35	6.9	3.2	2.3	2.8	2.6	2.7	2.1	1.52	1.68	1.88	5.2
.....	2.2	5.1	2.85	2.3	4.0	2.7	2.4	2.25	1.53	1.62	1.78	3.8
.....	2.2	4.2	2.7	2.2	6.0	2.3	2.2	2.5	1.5	1.62	1.57	3.8
.....	2.1	3.8	2.6	2.2	4.0	2.15	2.25	2.4	1.47	1.68	1.52	3.4
.....	2.1	3.6	2.6	2.2	3.4	2.0	2.2	2.2	1.48	1.82	1.8	3.2
.....	2.25	3.3	2.5	2.3	3.2	2.1	2.15	2.3	1.6	2.2	1.8	2.95
.....	2.35	3.2	2.5	2.4	3.0	2.05	2.1	2.0	1.25	1.95	1.75	2.9
.....	2.1	.....	2.4	2.4	2.9	2.4	2.1	1.9	1.42	1.8	1.75	3.0
.....	2.1	.....	2.5	2.6	2.8	2.25	2.2	1.85	1.47	1.75	1.52	3.1
.....	2.1	.....	2.5	.....	2.6	.....	2.2	1.85	.....	1.75	.....	2.85

Low gage heights can be accounted for as resulting from storage at the Gainesville water-power
t.

Rating table for Chattahoochee River near Norcross from January 9, 1903, to December 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	480	2.90	2,060	4.70	4,170	8.00	8,805
1.20	515	3.00	2,190	4.80	4,295	8.20	9,125
1.30	560	3.10	2,300	4.90	4,425	8.40	9,445
1.40	615	3.20	2,410	5.00	4,555	8.60	9,775
1.50	680	3.30	2,520	5.20	4,815	8.80	10,105
1.60	750	3.40	2,630	5.40	5,075	9.00	10,440
1.70	830	3.50	2,745	5.60	5,345	9.50	11,290
1.80	920	3.60	2,860	5.80	5,615	10.00	12,155
1.90	1,015	3.70	2,975	6.00	5,885	10.50	13,030
2.00	1,120	3.80	3,090	6.20	6,160	11.00	13,920
2.10	1,225	3.90	3,205	6.40	6,440	11.50	14,825
2.20	1,330	4.00	3,320	6.60	6,720	12.00	15,760
2.30	1,435	4.10	3,440	6.80	7,005	12.50	16,725
2.40	1,540	4.20	3,560	7.00	7,295	13.00	17,700
2.50	1,645	4.30	3,680	7.20	7,585	14.00	19,650
2.60	1,750	4.40	3,800	7.40	7,885	15.00	21,600
2.70	1,860	4.50	3,920	7.60	8,185	16.00	23,550
2.80	1,970	4.60	4,045	7.80	8,495		

[a] Above gage height 12.20 the rating curve is a tangent, the difference being 195 per tenth.

Estimated monthly discharge of Chattahoochee River near Norcross.

[Drainage area, 1,170 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
January 9–31	5,615	1,645	2,281	1.95	1.[illegible]
February	21,400	1,970	6,450	5.51	5.[illegible]
March	30,180	3,560	8,167	6.98	[illegible]
April	16,920	3,320	5,214	4.46	[illegible]
May	4,815	2,300	2,923	2.50	[illegible]
June	14,280	2,300	4,463	3.81	[illegible]
July	7,005	1,645	2,343	2.00	[illegible]
August	6,020	1,225	2,055	1.76	[illegible]
September	4,425	1,015	1,466	1.25	[illegible]
October	1,330	1,015	1,103	.943	[illegible]
November	1,860	1,015	1,222	1.04	[illegible]
December	1,435	1,015	1,110	.949	[illegible]
1904.					
January	2,520	920	1,306	1.12	[illegible]
February	4,945	1,225	1,967	1.68	[illegible]
March	5,885	1,435	2,227	1.90	[illegible]
April	2,975	1,435	1,729	1.48	[illegible]
May	3,380	1,015	1,510	1.29	[illegible]
June	1,805	515	987	.844	[illegible]
July	1,225	560	814	.696	[illegible]
August	9,125	830	2,079	1.78	[illegible]
September	1,540	515	764	.653	[illegible]
October	588	480	530	.453	[illegible]
November	968	537	689	.589	[illegible]
December	3,090	588	1,119	.956	[illegible]
The year	9,125	480	1,310	1.12	[illegible]
1905.					
January	15,570	948	2,238	1.91	[illegible]
February	14,820	1,120	3,753	3.21	[illegible]
March	2,520	1,540	1,899	1.62	[illegible]
April	1,750	1,330	1,540	1.32	[illegible]
May	5,885	1,540	2,552	2.18	[illegible]
June	1,860	1,120	1,381	1.18	[illegible]
July	13,030	1,225	2,780	2.38	[illegible]
August	3,540	968	1,609	1.38	[illegible]
September	1,382	538	824	.704	[illegible]
October	2,745	680	991	.847	[illegible]
November	1,330	515	893	.763	[illegible]
December	9,445	667	3,225	2.76	[illegible]
The year	15,570	515	1,974	1.69	[illegible]

CHATTAHOOCHEE RIVER NEAR VININGS.

This station was established in 1905 at a new iron highway bridge 1 mile east of Vinings and about 10 miles northwest of Atlanta. It is about 10 miles below the developed power at Bull Sluice.

The current of the section is fairly good and regular. The bed is probably somewhat shifting, but there is a stretch of swift water immediately below, running among permanent rocks which will probably control the water level at the station. The left bank is high and will not overflow; the right bank is only about 20 feet above low water for a width of 900 feet and will overflow during very high floods.

Discharge measurements are made from a bridge of two 140-foot spans, with 50 feet of wooden approach at the left bank and 100 feet at the right bank.

No gage has been established. The effect of the water power above being to cause a great amount of fluctuation in the flow, the mean daily gage height can be obtained only by the use of an automatic recording gage, and until this is installed the measurements are made mainly as investigations relative to the accuracy of the rating in case the original Chattahoochee River station, which was located at Oakdale, 4 miles below, should be continued at this place. Gage heights are determined directly from the bench mark, which is the top of the upstream end of the second floor beam from the left bank; elevation, 31.00 feet above the datum of the assumed gage.

Discharge measurements of Chattahoochee River near Vinings.

Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*
May 4	4.51	1,966
August 18	4.68	2,003
August 18	4.57	1,861
October 17	3.43	856
November 27	3.74	1,002

CHATTAHOOCHEE RIVER AT OAKDALE.

This station was established at Oakdale on October 17, 1895, by Cyrus C. Babb. It is located at the Southern Railway bridge, 1 mile above the mouth of Proctor Creek, 2 miles below the mouth of Peachtree Creek, one-fourth mile west of Chattahoochee, 1 mile east of Oakdale, and 8 miles northwest of Atlanta. The flow is obstructed by rafts, which have to be cleared from the channel occasionally. The channel is straight and the current swift. The banks are subject to overflow. The bed of the stream is constant, and the results are fairly good except at high stages, when the water flows through the trestlework.

Discharge measurements were made from the railway bridge, the initial point for soundings being the end of the iron bridge on the right bank, upstream side.

On July 1, 1898, the location of the station was changed to Mason and Turners Ferry, 1 mile below Oakdale. The gage at this point, known as the "Oakdale lower gage," is nailed to a tree on the right bank, 100 feet below the ferry, and set 1 foot lower than the gage at the Southern Railway bridge. On June 1, 1899, the lower gage was discontinued and the upper gage resumed and adopted by the United States Weather Bureau, the United States Geological Survey still receiving the records and making the current-meter discharge measurements at this point. The gage now used is in two sections, the first, reading from zero to 8 feet, fastened to a willow tree 100 feet above the bridge on the left bank; the second, reading from 8 to 26 feet, fastened to an ash tree 30 feet above the bridge on the left bank. It is set on the same datum as the old wire gage of the United States Geological Survey established at that point by Mr. Babb in 1895, and above referred to. Its zero point is 753.5 feet above sea level. The observer was J. B. Austin.

Bench mark No. 2 is a large bridge spike in a sycamore tree about 50 feet above the bridge on the left bank; elevation, 11.00 feet above the zero of the gage. Bench mark No. 3, determined by measuring down to the water, is the top of the iron girder, 40 feet from the initial point for soundings, on the upstream side of the bridge; elevation, 57.55 feet above the zero of the gage.

The station was discontinued by the Weather Bureau on November 30, 1904, but the single daily readings for several months before that time are not considered reliable as representing the flow of the river, on account of the operation of a large water-power plant above. Only the records for the first five months of that year are used.

The station was reestablished in 1905 at a new iron highway bridge just below the old Mason and Turners Ferry, where the Oakdale "lower gage" was maintained as a regular station during parts of the years 1898 and 1899. It is 1½ miles below the Southern Railway bridge where the Oakdale station was located.

Discharge measurements are made from the bridge of two 130-foo spans, with 300 feet of wooden approach at the right bank and 730 fee at the left. At high floods both banks will overflow to the extent o the bridge approaches, but can not get beyond at either end. Th current is mostly swift and is irregular at places.

Gage heights are determined directly from the bench mark, which i the top of the downstream end of the second floor beam from the righ bank; elevation, 35.00 feet above the datum of the assumed gage.

Discharge measurements of Chattahoochee River at Oakdale.

Date.	Gage height.	Discharge.
1895.	*Feet.*	*Sec.-ft.*
	0.40	1,096
	.69	1,380
1896.		
	.70	1,361
	.00	985
	.33	1,153
	1.01	1,380
	.55	1,250
	.28	1,126
	18.05	18,180
	12.80	11,140
	3.01	2,957
	1.88	2,066
	4.60	4,640
	2.22	2,470
	− .18	958
	− .55	744
	− .50	775
1897.		
	2.90	3,065
	2.70	2,703
	1.65	2,055
	1.50	2,014
	1.35	1,929
	1.35	2,003
	1.44	1,991
	.94	1,523
	.57	1,306
	12.90	15,620
	.84	1,276
	.33	1,196
).	− .12	849
7.	− .30	778
	− .50	659
	.46	1,194
l.	− .05	879
	2.65	2,426
	1.70	1,926
1898.		
	1.71	2,165
	.65	1,446
	9.95	12,580
	.85	1,501
	.80	1,459
	[b] 1.30	1,088
	[b] 1.35	1,137
	[b] .80	782
	[b] 2.45	2,292
	[b] 4.90	4,157
[a]	[b] 20.10	24,410
[a]	[b] 4.77	4,735

Date.	Gage height.	Discharge.
1899.	*Feet.*	*Sec.-ft.*
March 11[c]	4.35	4,397
May 1[c]	3.80	3,452
May 26[c]	2.36	2,678
June 14[c]	3.92	4,788
September 9	1.32	1,452
October 6	.67	1,150
October 17	.54	1,083
November 18	.42	988
1900.		
January 4	1.53	1,784
March 27	5.85	5,504
July 6	4.00	3,886
September 12	1.08	1,456
November 29	2.32	2,334
1901.		
January 12	19.85	21,710
April 11	3.55	3,247
June 19	4.75	4,446
July 30	3.16	2,983
October 24	1.90	1,896
1902.		
January 14	2.50	2,477
January 25	2.50	2,104
February 3	16.70	17,590
February 4	7.20	6,573
June 23	1.85	1,902
July 10	1.75	1,680
September 16	1.10	1,300
November 1	.75	1,086
November 20	1.12	1,234
1903.		
March 2	9.95	9,787
March 23	21.85	33,620
April 23	5.03	4,836
June 2	12.20	12,480
September 2	1.25	1,612
October 7	1.10	1,359
November 5	1.90	1,882
1904.		
February 11	3.28	2,926
March 15	3.50	3,233
May 3	1.38	1,361
June 29	.60	1,030
1905.		
April 28[d]	[c] 4.11	1,284
May 25[d]	[c] 8.16	4,687
May 25[d]	[c] 8.30	4,845

[a] measurements made at Mason and Turners Ferry and referred to "Oakdale lower gage."
[b] ht from "Oakdale lower gage."
[c] ient made at Mason and Turners Ferry, but referred to the upper gage at Southern Rail-

[d] measurement made at the bridge just below Mason and Turners Ferry.
[e] hts referred to the bench mark on the bridge.

Daily gage height, in feet, of Chattahoochee River at Oakdale.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1895.				1895.				1895.			
1		0.75	0.5	12		1.35	1.1	23	0.2	0.5	
2		1.7	.5	13		1.0	1.0	24	.3	.5	
3		1.0	.55	14		.75	.65	25	.25	.5	
4		.6	.6	15	0.4	.6	.6	26	.2	.55	
5		.5	.6	16	.4	.6	.55	27	.25	.55	
6		.55	.5	17	.35	.55	.55	28	.25	.7	
7		.45	.45	18	.3	.6	.5	29	.3	.75	
8		.4	.4	19	.25	.5	.4	30	.5	.45	
9		.6	.4	20	.3	.55	.5	31	.5	.....	
10		.8	.6	21	.2	.5	.65				
11		1.0	1.3	22	.25	.5	1.0				

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1896.												
1	3.2	1.7	1.4	1.4	0.75	0.25	−0.35	0.45	−0.4	0.2	0.5	
2	2.0	1.55	1.35	1.7	.75	1.4	− .4	.5	− .6	.1	.5	
3	1.0	1.75	1.4	2.75	.75	1.45	− .45	1.4	− .6	.05	.65	
4	1.2	2.1	1.45	1.85	.7	2.1	+ .15	1.7	− .6	− .2	1.13	
5	1.1	2.2	1.4	1.35	.65	1.6	− .2	.75	− .6	− .3	1.6	
6	1.0	2.8	1.35	1.3	3.15	1.15	− .15	.4	− .6	− .35	1.35	
7	.8	3.7	1.95	1.1	1.7	.6	+2.0	.2	− .6	− .4	1.2	
8	.95	4.3	1.75	1.15	1.2	.4	12.25	.15	− .55	− .5	1.1	
9	1.2	5.8	1.55	1.05	.9	.7	17.7	.15	− .55	− .5	1.0	
10	1.25	6.55	1.5	1.05	.75	.7	18.45	.1	− .5	− .5	1.05	
11	1.0	4.3	1.75	1.05	.65	.65	4.75	.05	− .5	− .6	1.05	
12	.85	3.3	1.85	1.0	.6	.5	3.25	.05	− .55	− .6	1.6	
13	.8	2.8	1.55	1.0	.5	.3	3.1	.3	− .6	− .55	3.8	
14	.75	2.95	1.35	.9	.5	.2	2.9	.25	− .6	− .55	4.6	
15	.7	4.1	1.2	.9	.4	− .05	1.95	.05	− .6	− .55	2.8	
16	.85	2.9	1.15	.9	.3	+ .05	3.0	.1	− .65	− .55	1.5	
17	2.4	2.55	1.1	.85	.3	− .05	4.4	.1	− .65	− .55	1.0	
18	2.35	2.2	1.35	.85	.25	+ .1	2.7	.1	− .65	− .55	.8	
19	2.1	2.1	1.7	.85	.25	.15	1.75	− .1	− .65	− .55	.6	
20	1.5	1.8	1.65	.85	.2	.55	1.9	− .25	− .65	− .55	.5	
21	1.25	1.6	1.45	.75	.15	1.6	1.65	− .3	− .5	− .55	.4	
22	1.8	1.4	1.35	.75	.2	.45	1.9	− .3	− .15	− .5	.4	
23	6.3	1.55	1.4	.65	.2	.5	2.45	− .3	+ .4	− .23	.3	
24	9.8	1.6	1.45	.7	1.1	.3	2.4	− .3	− .6	− .05	.35	
25	9.95	1.5	1.4	.65	1.55	.2	1.5	+1.0	− .1	+ .05	.2	
26	5.1	1.4	1.35	.65	.65	− .1	1.3	− .1	− .4	.1	.2	
27	3.55	1.35	1.25	1.4	.85	+ .45	.9	− .3	− .4	.15	.2	
28	2.65	1.3	1.2	1.7	.65	− .1	.8	− .3	+ .2	.25	.2	
29	2.3	1.55	1.15	1.15	.95	− .2	.8	− .3	.45	.9	.2	
30	2.1	.....	1.2	.85	.4	− .25	.8	− .35	.3	.65	.2	
31	1.8	.....	1.2	.....	.35	.....	.5	− .4	.....	.5	.....	
1897.												
1	.2	3.1	2.0	2.8	4.1	1.0	.5	.85	.5	− .5	.0	
2	.2	4.5	1.8	4.1	3.2	1.0	.45	.8	.35	− .5	.35	
3	.2	4.9	1.8	5.0	2.8	1.15	.55	.9	.1	− .5	.35	
4	.3	3.25	2.0	7.0	2.5	1.35	.55	.8	.2	− .45	.95	
5	.4	3.7	1.9	12.8	2.4	1.15	1.15	.7	.1	− .5	.35	
6	.4	4.1	9.0	17.0	2.25	1.05	.65	.65	.0	− .5	.3	
7	.35	5.5	9.2	8.0	2.15	1.0	2.5	1.6	.0	− .5	.15	
8	.35	5.0	5.5	5.4	2.05	.85	1.8	1.35	− .05	− .4	.15	
9	.3	3.1	4.45	6.0	2.0	1.1	1.32	1.4	− .15	− .45	.1	
10	.3	2.4	4.05	5.0	1.95	1.0	2.45	1.2	− .15	− .45	.15	
11	.2	3.4	3.6	4.6	1.9	1.0	2.45	.95	− .2	+1.35	.1	
12	.2	4.0	6.4	4.1	1.9	.85	1.6	.8	− .2	1.5	.05	
13	.4	5.3	12.6	4.0	1.85	.75	1.2	.65	− .15	1.4	.0	
14	3.0	4.0	10.0	4.55	1.9	.65	.85	.5	− .2	− .35	− .05	
15	3.7	2.6	8.4	4.05	2.35	.55	.6	.45	− .25	+ .15	− .1	
16	2.8	2.6	6.8	4.0	1.85	.5	.5	.4	− .25	.0	− .05	
17	2.4	2.4	5.45	3.5	1.7	1.55	4.2	2.9	− .3	− .05	+ .1	
18	4.0	2.1	6.1	2.2	1.5	1.0	2.45	1.25	− .3	− .15	− .05	
19	4.6	1.9	5.8	3.05	1.45	1.05	7.65	.95	− .3	− .15	− .05	
20	5.5	2.5	5.55	3.0	1.35	.55	12.3	.65	− .35	.0	− .05	

Daily gage height, in feet, of Chattahoochee River at Oakdale—Continued.

ay.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
97.												
.....	7.5	2.5	5.0	2.8	1.35	1.35	10.3	0.55	−0.35	1.45	−0.05	0.95
.....	6.85	2.9	4.3	2.75	1.4	.75	6.1	1.15	− .35	.85	− .05	1.95
.....	3.9	5.1	4.5	2.7	1.4	.55	4.35	1.1	− .35	.15	− .05	2.95
.....	3.2	4.5	4.0	2.7	1.35	.45	2.2	1.0	− .3	.0	− .1	1.75
.....	2.0	3.6	3.9	2.65	1.3	.9	1.65	.6	− .25	.05	− .1	1.7
.....	1.65	2.9	3.35	2.6	1.2	.55	2.85	.5	− .3	.05	− .1	2.25
.....	.45	2.4	3.1	2.4	1.1	.45	2.3	.25	− .35	− .05	+ .5	1.95
.....	1.1	2.05	3.0	2.1	1.05	.3	1.35	.2	− .35	− .05	1.35	1.85
.....	1.25	.....	2.75	2.0	1.0	1.0	1.2	.2	− .35	− .05	1.85	1.35
.....	1.5	.....	2.7	2.2	1.05	.75	1.1	.15	− .4	− .1	1.5	2.05
.....	2.0	.....	2.15	.....	1.1	.....	.95	1.65	.....	− .1	.....	.95
98.												
.....	.75	1.5	.4	5.5	1.85	.25	[a].95	[a]2.3	[a]3.1	[a]2.4	[a]3.1	[a]3.7
.....	.55	1.3	.4	3.45	1.6	.3	1.1	2.0	20.0	2.5	3.0	3.4
.....	.55	1.05	.55	2.6	1.55	.25	.75	1.9	27.75	2.9	2.9	3.6
.....	.5	1.0	.8	3.05	1.45	.2	.7	8.5	27.0	15.0	3.0	4.1
.....	.55	.95	.85	8.7	1.35	.09	1.4	14.0	22.0	19.25	3.1	5.5
.....	.55	1.0	.7	11.15	1.2	.03	1.1	16.0	15.0	23.5	3.8	4.75
.....	.55	.95	.55	5.8	1.2	.0	1.85	9.0	12.0	16.25	3.5	4.1
.....	.6	.8	.45	3.8	1.1	− .05	3.7	6.0	7.5	7.5	3.3	3.75
.....	.65	.75	.35	2.95	1.1	− .02	5.1	3.8	5.5	6.5	2.9	3.4
.....	.55	.7	.3	2.35	.9	− .1	4.75	4.3	5.1	5.5	2.8	3.1
.....	.55	.7	.3	2.3	.9	− .13	3.5	4.5	4.75	4.9	3.1	3.0
.....	.55	.7	.3	2.0	.9	− .2	2.3	5.8	4.4	4.5	3.8	3.3
.....	.85	.65	.3	1.75	1.2	.0	1.85	4.1	4.2	4.3	3.1	3.1
.....	1.25	.65	.5	1.75	.95	.13	2.5	7.5	3.9	4.0	3.6	2.95
.....	1.0	.55	1.05	1.9	.85	.08	4.2	5.5	3.75	3.9	4.1	2.9
.....	.85	.55	1.4	1.6	.8	.93	4.1	2.9	3.6	3.7	3.6	2.8
.....	.8	.45	3.5	1.45	.7	− .05	2.5	2.85	3.4	3.5	3.7	2.75
.....	.75	.6	1.75	1.3	.65	+1.5	1.85	2.4	3.3	5.7	4.05	2.85
.....	.75	.9	1.5	1.15	.6	1.65	1.75	2.9	3.2	7.9	4.75	2.95
.....	.9	1.05	1.05	1.2	.6	1.53	1.5	6.0	3.1	4.7	5.1	3.25
.....	1.5	.75	.85	1.4	.6	1.75	1.4	6.5	3.3	4.3	4.5	3.95
.....	2.3	.75	.75	1.35	.55	.35	1.45	4.5	2.9	4.9	3.75	3.5
.....	1.5	.55	.55	1.4	1.2	.1	1.5	3.9	3.1	5.3	3.5	7.1
.....	1.35	.55	.45	3.65	1.15	− .05	12.4	2.8	5.3	4.1	4.75	8.5
.....	2.95	.45	.4	4.55	1.25	− .15	6.3	2.75	3.25	3.8	3.75	5.75
.....	7.7	.4	.4	2.65	.8	− .15	3.4	2.9	2.95	3.5	3.5	4.1
.....	6.8	.45	.4	2.25	.8	− .2	3.8	7.5	2.8	3.4	3.3	3.75
.....	5.05	.6	1.15	2.85	.6	− .05	6.4	4.3	2.7	3.45	3.1	3.5
.....	4.35	.....	2.5	2.35	.3	− .07	5.85	2.8	2.6	3.3	3.75	2.95
.....	3.05	.....	6.3	1.85	.3	− .1	4.4	3.2	2.5	3.45	4.05	2.75
.....	2.7	.....	8.4	.....	.25	.....	3.75	3.2	.....	3.3	.....	3.1
99.												
.....	[b]4.25	[b]5.1	[b]9.8	[b]13.0	[b]4.7	2.45	1.5	1.7	4.6	.4	.6	1.3
.....	4.75	4.5	6.85	7.75	4.45	2.4	1.4	1.4	2.7	.1	.5	1.8
.....	3.6	5.8	6.17	6.5	4.4	2.3	1.35	1.2	2.1	.1	.5	1.5
.....	3.4	4.9	5.9	7.75	4.35	2.1	1.25	1.1	1.9	.1	.5	1.4
.....	3.1	6.5	8.1	6.5	4.5	2.05	1.2	1.1	1.6	.4	.5	1.1
.....	3.75	10.0	8.5	5.9	5.1	2.0	1.4	1.0	1.0	.6	.4	.9
.....	6.75	16.0	6.4	6.5	4.6	2.0	1.4	.9	.9	1.6	.4	.8
.....	6.1	21.5	5.9	7.75	4.35	2.05	1.4	.8	.8	1.5	.4	.8
.....	5.25	13.4	5.5	7.5	4.25	2.05	1.4	.7	.7	2.0	.4	.8
.....	4.7	9.5	5.25	7.1	4.1	2.1	1.3	.6	.7	1.2	.4	.8
.....	6.3	6.4	5.1	6.8	4.0	2.15	1.3	.6	3.0	.9	.4	.7
.....	4.75	5.5	5.0	5.75	3.95	2.75	1.1	.5	1.1	.7	.7	2.2
.....	4.25	4.9	4.95	5.25	3.9	4.8	1.1	.5	.9	.7	.5	6.4
.....	4.5	4.1	6.25	5.2	3.85	4.0	.9	.5	.8	.7	.5	3.1
.....	5.5	4.6	10.0	5.1	3.8	2.9	.8	.5	.7	.6	.5	2.4
.....	4.9	5.6	21.5	5.0	3.7	2.25	.8	.6	.6	.5	.6	1.8
.....	4.75	7.25	24.25	5.25	3.6	2.05	.8	.6	.5	.5	.6	1.6
.....	4.5	6.1	11.0	4.95	3.5	2.05	1.0	.6	.3	.6	.5	1.3
.....	4.1	5.6	10.5	5.0	3.55	2.0	1.3	.5	.4	.6	.5	1.1
.....	3.9	4.9	15.0	4.95	3.5	1.9	1.0	.4	.4	.8	.4	1.2

[a] heights July 1 to December 31, 1898, were recorded from "Oakdale lower gage" at Mason and Ferry.

[b] heights January 1 to May 31, 1899, were recorded from "Oakdale lower gage" at Mason and Ferry.

Daily gage height, in feet, of Chattahoochee River at Oakdale—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1899.											
21	3.75	5.25	8.75	4.85	3.45	1.75	1.35	0.4	0.4	0.9	0.4
22	3.6	5.2	7.25	4.65	5.5	1.7	3.8	.4	.4	.7	.9
23	3.9	5.0	9.5	4.75	3.6	1.55	2.3	.3	.3	.6	2.0
24	4.25	4.9	9.0	4.95	3.5	1.55	1.9	.2	.3	.5	2.4
25	4.1	4.6	6.5	7.25	3.35	1.8	.8	.1	.3	.5	1.7
26	4.25	10.23	7.1	8.0	3.25	2.05	2.1	.2	.3	.4	3.0
27	3.7	22.13	6.2	6.25	3.15	2.2	2.1	5.2	.2	.5	2.8
28	3.45	18.88	6.1	5.25	3.1	2.0	5.9	3.4	.2	.5	2.7
29	3.25	.....	7.9	5.0	3.2	1.8	3.4	1.4	.2	.9	2.1
30	3.5	.....	6.45	4.8	6.1	1.6	3.3	3.2	.2	.7	1.8
31	4.65	.....	12.3	.....	3.4	.....	3.2	2.8	.....	.6	.....
1900.											
1	1.0	1.0	4.5	3.4	5.0	3.0	5.0	5.0	2.0	2.1	2.4
2	.7	1.0	5.9	3.1	4.8	3.7	4.5	4.5	2.0	2.1	2.4
3	.5	.9	4.3	3.0	4.5	4.0	6.0	4.0	2.0	2.1	3.0
4	.5	.9	3.6	2.7	4.0	4.7	7.5	4.0	1.9	3.0	2.8
5	.9	2.9	3.3	2.7	3.9	4.0	7.0	4.0	1.7	3.4	2.7
6	1.2	3.5	3.1	2.8	3.0	3.8	6.5	3.5	1.8	3.8	2.5
7	1.3	2.2	3.0	2.8	3.0	4.7	6.4	3.5	1.8	4.0	2.5
8	1.3	1.9	8.8	2.7	3.0	9.7	6.0	3.5	1.8	4.0	2.5
9	1.2	3.8	7.9	2.7	2.9	10.5	5.8	3.0	1.7	3.9	2.4
10	1.1	4.3	6.9	2.6	2.9	8.0	5.7	3.0	1.7	3.5	2.4
11	2.0	7.4	5.5	3.0	2.8	5.0	5.6	3.0	1.5	3.5	2.4
12	3.9	8.0	4.0	6.4	2.7	4.0	5.4	3.0	1.5	3.9	2.4
13	3.0	15.5	3.1	5.4	2.7	4.5	5.2	3.0	4.3	4.3	2.3
14	2.8	20.7	3.2	4.2	2.6	4.0	5.0	3.0	8.4	4.2	2.2
15	2.2	16.4	3.0	3.8	2.6	3.5	4.5	3.0	10.2	4.0	2.1
16	1.9	6.0	5.0	3.3	2.6	3.0	4.4	2.7	8.2	3.6	2.1
17	1.7	4.8	3.6	4.0	2.5	3.5	4.3	3.0	6.0	3.4	2.0
18	1.8	3.8	3.0	6.9	3.5	4.5	4.2	4.0	3.1	3.2	2.0
19	2.9	3.5	4.5	9.0	3.7	6.0	4.1	3.5	3.0	3.0	1.8
20	4.0	3.1	5.9	7.3	3.0	6.5	4.0	3.5	2.8	3.0	1.5
21	5.8	3.0	6.6	6.3	3.1	8.0	3.9	3.0	2.8	2.8	1.5
22	4.8	4.2	4.8	7.0	3.2	9.0	3.8	3.0	2.7	3.0	1.8
23	2.9	4.3	4.1	6.3	3.7	13.6	3.7	3.0	2.5	3.3	2.0
24	3.0	3.8	3.5	13.6	3.9	18.0	3.7	3.0	2.3	3.3	1.9
25	2.6	4.1	7.7	7.5	3.7	17.5	4.0	2.7	2.3	3.0	1.8
26	1.9	4.0	7.5	6.0	3.5	11.4	5.0	2.7	2.0	3.0	1.8
27	1.7	3.3	6.0	5.5	3.4	10.5	6.0	2.6	2.0	2.9	3.6
28	1.5	3.0	4.5	5.0	3.2	7.5	6.5	2.5	1.8	2.8	3.3
29	1.5	.....	4.0	5.0	3.0	6.0	7.4	3.0	1.5	2.6	2.5
30	1.4	.....	3.8	5.0	2.5	5.5	10.0	3.0	1.5	2.4	2.0
31	1.3	.....	3.5	.....	2.4	.....	6.0	2.7	.....	2.4	.....
1901.											
1	2.1	4.3	2.4	4.5	3.1	6.8	4.7	2.6	6.0	3.7	1.7
2	2.3	4.4	2.4	4.5	3.1	6.6	4.1	2.3	5.0	4.6	1.7
3	2.3	5.0	2.3	4.7	3.1	6.0	3.9	2.1	4.8	4.2	1.6
4	2.2	5.2	2.3	4.5	3.0	6.0	3.0	1.9	4.6	3.9	1.8
5	2.2	5.0	2.3	4.3	3.0	5.3	2.9	1.8	4.4	3.6	1.8
6	2.2	4.7	2.1	4.0	2.9	4.7	2.8	2.2	4.0	3.1	1.8
7	2.1	4.1	2.1	4.0	2.9	4.3	2.8	9.9	3.7	2.9	1.7
8	2.1	4.0	2.1	3.7	3.0	4.0	2.7	3.2	3.6	2.8	1.7
9	2.5	4.2	2.2	3.7	3.0	3.6	2.7	3.0	3.6	2.8	1.7
10	3.0	4.1	3.3	3.7	3.0	3.4	2.6	2.9	3.6	2.7	1.7
11	9.0	4.0	6.5	3.7	3.0	3.2	2.6	5.7	3.8	2.7	1.7
12	19.9	3.6	5.5	6.4	3.0	3.4	2.5	4.0	3.7	2.7	1.6
13	22.0	3.2	4.4	12.0	3.1	3.8	2.2	4.2	3.6	3.8	1.6
14	16.0	3.1	3.4	9.5	3.0	5.1	2.1	4.4	3.9	3.2	1.8
15	8.4	3.0	3.2	7.0	3.0	10.0	2.1	5.6	3.7	2.9	1.6
16	5.1	2.9	3.2	5.3	2.9	9.8	2.2	9.8	3.7	2.8	1.7
17	4.4	2.9	3.0	5.0	2.8	8.3	9.1	10.5	3.8	2.8	1.6
18	4.0	2.8	3.0	6.1	2.8	7.1	5.0	9.3	14.6	2.8	1.6
19	4.0	2.8	3.0	7.7	2.7	4.2	3.9	9.2	7.2	2.7	1.7
20	3.8	2.7	3.0	7.0	3.2	3.9	9.0	9.8	4.3	2.7	1.9
21	3.7	2.7	3.2	5.8	7.1	3.7	4.2	10.8	3.9	2.7	1.8
22	3.7	2.6	3.2	6.0	18.7	3.5	3.0	17.5	3.9	2.5	1.7
23	3.4	2.6	3.1	5.4	20.0	3.4	2.9	19.8	3.8	2.3	1.8
24	3.7	2.5	3.2	5.1	7.8	3.2	2.7	16.4	3.8	2.1	1.8
25	3.8	2.5	5.3	4.8	6.0	3.2	2.6	10.3	3.6	2.0	1.9

aily gage height, in feet, of Chattahoochee River at Oakdale—Continued.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	3.5	2.5	10.5	4.8	5.2	4.9	2.4	10.1	3.4	2.0	1.8	1.8
	3.6	2.4	23.5	4.5	4.0	4.2	2.8	9.8	3.1	1.8	1.7	1.8
	3.4	2.4	17.0	4.2	3.7	3.9	2.6	9.1	2.9	1.7	1.7	2.4
	3.1	.....	9.5	3.5	3.1	3.9	2.7	8.7	3.2	1.7	1.7	22.0
	4.6	.....	7.3	3.1	3.1	3.8	3.1	6.8	3.6	1.7	1.6	27.0
	4.3	.....	5.0	.....	7.1	.....	3.0	6.6	.....	1.7	.....	25.0
	9.2	7.2	25.0	7.1	3.4	3.2	2.6	2.1	2.4	2.1	.8	2.4
	6.0	18.0	20.8	6.4	3.8	3.1	2.6	1.9	2.1	1.5	.7	2.6
	5.1	19.2	10.3	6.2	3.8	3.1	3.4	1.8	2.1	1.6	.7	7.0
	4.2	8.6	7.1	5.8	3.6	3.0	2.8	1.8	2.1	1.8	.5	8.6
	3.7	6.0	7.8	5.2	3.6	2.8	2.6	1.8	2.4	1.5	.5	4.9
	3.2	4.3	6.0	4.8	3.6	2.8	2.4	1.8	2.3	1.6	.7	4.1
	3.1	3.2	5.2	4.9	3.6	2.8	2.4	1.9	2.1	2.1	.9	3.3
	2.8	2.8	4.6	4.9	3.5	2.8	2.1	1.9	2.0	1.8	.8	2.4
	2.5	2.8	4.4	5.0	3.5	2.8	2.1	1.8	3.5	1.6	1.0	1.9
	2.3	2.7	4.1	4.4	3.5	2.7	1.8	1.8	3.2	1.5	1.2	1.8
	2.3	2.7	3.8	4.2	3.6	2.7	1.8	1.9	2.8	1.4	1.3	1.6
	2.3	2.8	3.6	4.2	3.8	2.7	3.6	1.8	2.3	1.8	1.0	1.6
	2.3	2.8	5.5	3.8	3.6	2.7	2.4	1.8	2.3	2.1	.9	1.8
	2.1	2.8	4.8	3.8	3.6	2.6	2.2	1.8	4.8	1.9	.7	1.6
	2.1	2.8	5.7	3.8	3.6	2.8	2.6	1.7	3.5	1.4	.6	1.7
	2.1	3.0	11.4	3.6	3.8	5.6	2.4	1.7	2.8	1.6	.8	5.4
	2.1	3.2	8.0	3.8	3.8	4.2	2.2	1.7	2.4	1.2	.9	7.0
	2.1	3.1	6.2	4.1	3.8	3.4	2.1	1.7	2.4	1.4	1.3	6.0
	2.3	2.8	5.6	4.1	3.8	4.0	1.8	1.7	2.6	1.5	1.0	4.0
	2.2	2.8	4.8	3.8	3.5	3.6	1.8	1.8	2.6	1.6	1.1	2.7
	2.6	3.0	4.6	3.8	3.5	4.1	2.2	1.8	2.6	1.2	1.0	3.0
	2.6	3.0	4.4	3.8	3.5	4.4	2.0	1.8	2.4	1.0	.8	2.9
	2.5	2.8	4.1	3.8	3.4	4.2	1.9	1.6	2.1	.8	.8	2.4
	2.4	2.8	4.1	3.6	3.2	4.2	1.8	1.6	2.1	.7	.9	2.0
	2.4	3.6	3.8	3.6	3.2	3.8	1.8	1.6	5.7	.5	1.0	1.8
	2.4	3.6	3.8	3.6	3.2	3.8	1.8	1.6	5.8	.8	4.8	1.7
	2.4	3.8	4.2	3.6	3.2	3.0	1.8	1.5	4.6	.9	4.3	1.6
	2.8	23.2	6.4	3.6	3.2	2.8	2.6	1.8	7.9	1.0	3.6	1.7
	3.1	.....	21.0	3.4	3.1	2.8	2.7	2.7	5.2	.9	1.9	2.0
	4.0	.....	21.7	3.5	3.1	2.8	2.5	2.6	3.1	.7	1.6	3.4
	4.6	.....	9.8	.....	3.1	.....	2.1	2.4	.....	.5	.....	3.0

	Jan.	Feb.	Mar.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Nov.	Dec.
						1903.					
	2.6	3.0	19.4	1.0	1.0	17	2.5	24.0	5.9	1.3	1.3
	2.8	2.9	12.0	.....	1.0	18	2.4	25.6	4.8	1.7	1.3
	3.1	3.4	7.2	1.5	1.0	19	2.2	9.4	4.6	1.5	1.3
	2.8	7.6	6.6	2.0	1.0	20	2.1	4.9	5.0	1.5	1.5
	2.5	10.2	5.8	2.0	1.0	21	2.0	2.7	11.4	1.5	1.6
	2.4	6.7	6.4	3.0	1.0	22	2.0	3.0	13.0	1.3	1.6
	2.6	7.7	5.8	2.0	1.0	23	1.9	3.2	21.0	1.3	1.5
	2.8	18.0	5.8	1.5	1.0	24	2.2	3.7	23.4	1.2	1.5
	2.7	15.6	5.5	1.5	1.0	25	2.5	4.1	22.4	1.1	1.5
	2.5	7.8	7.4	1.3	1.2	26	2.4	3.7	8.8	1.2	1.7
	3.3	11.0	12.4	1.3	1.2	27	2.0	4.2	7.5	1.0	1.7
	4.0	16.0	15.0	1.5	1.0	28	2.3	11.4	6.8	1.0	1.5
	4.9	10.6	11.4	1.4	1.3	29	2.7	.....	10.8	1.0	1.5
	3.8	4.7	7.7	1.3	1.5	30	4.5	.....	16.6	1.0	1.4
	3.2	5.8	6.8	1.2	1.5	31	3.4	.....	15.8	.....	1.3
	2.8	5.8	6.0	1.2	1.3						

Daily gage height, in feet, of Chattahoochee River at Oakdale—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1904.						1904.					
1	1.3	1.6	2.0	2.0	1.5	17	1.7	1.6	2.5	2.0	
2	1.3	1.5	2.3	2.0	1.5	18	1.5	1.6	2.0	2.0	
3	1.7	1.7	2.4	1.9	1.4	19	1.9	1.7	2.0	1.8	
4	1.3	1.5	2.4	1.8	1.4	20	1.6	2.5	2.0	1.7	
5	1.3	1.5	2.0	1.8	1.4	21	1.5	2.7	1.8	1.7	
6	1.3	1.5	2.3	1.5	1.4	22	1.7	4.5	2.0	1.7	
7	1.4	1.6	4.5	1.7	1.4	23	4.0	7.7	3.8	1.7	
8	1.4	3.6	8.2	2.5	1.8	24	4.0	4.3	4.0	1.5	
9	1.3	3.0	4.0	3.0	4.0	25	3.5	3.5	4.4	1.5	
10	1.4	3.6	3.0	5.0	4.5	26	3.0	3.0	4.0	1.5	
11	1.4	4.0	2.8	3.0	2.7	27	3.0	2.8	3.0	1.7	
12	1.3	2.7	2.5	2.5	2.0	28	3.0	2.4	2.6	1.7	
13	1.5	2.0	2.2	2.2	1.8	29	3.5	2.0	2.3	1.5	
14	1.6	1.8	2.5	2.0	1.7	30	3.6	.....	2.0	1.5	
15	1.5	2.0	4.5	1.9	1.7	31	1.6	.....	1.8	.....	
16	1.5	1.9	3.0	1.9	1.7						

Rating tables for Chattahoochee River at Oakdale.

OCTOBER 15, 1895, TO DECEMBER 31, 1896.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
-0.60	760	0.70	1,356	2.00	2,155	3.30	3,223
- .50	790	.80	1,412	2.10	2,227	3.40	3,315
- .40	821	.90	1,469	2.20	2,301	3.50	3,410
- .30	856	1.00	1,528	2.30	2,377	3.60	3,508
- .20	895	1.10	1,586	2.40	2,455	3.70	3,608
- .10	938	1.20	1,646	2.50	2,535	3.80	3,711
.00	985	1.30	1,707	2.60	2,616	3.90	3,817
.10	1,035	1.40	1,769	2.70	2,698	4.00	3,928
.20	1,086	1.50	1,832	2.80	2,782	4.20	4,154
.30	1,138	1.60	1,896	2.90	2,868	4.40	4,391
.40	1,191	1.70	1,961	3.00	2,956	4.60	4,640
.50	1,245	1.80	2,027	3.10	3,044	4.80	4,899
.60	1,300	1.90	2,085	3.20	3,133	5.00	5,170

JANUARY 1 TO DECEMBER 31, 1897.[b]

0.50	675	1.50	1,855	4.00	4,340	8.00	9,740
- .40	725	1.60	1,927	4.20	4,610	8.20	10,010
- .30	775	1.70	2,000	4.40	4,880	8.40	10,280
- .20	825	1.80	2,075	4.60	150	8.60	10,550
- .10	876	1.90	2,150	4.80	5,420	8.80	10,820
.00	928	2.00	2,226	5.00	5,690	9.00	11,090
.10	980	2.10	2,303	5.20	5,960	9.20	11,360
.20	1,035	2.20	2,380	5.40	6,230	9.40	11,630
.30	1,091	2.30	2,460	5.60	6,500	9.60	11,900
.40	1,148	2.40	2,540	5.80	6,770	9.80	12,170
.50	1,206	2.50	2,620	6.00	7,040	10.00	12,440
.60	1,266	2.60	2,702	6.20	7,310	11.00	13,790
.70	1,326	2.70	2,785	6.40	7,580	12.00	15,140
.80	1,388	2.80	2,870	6.60	7,850	13.00	16,490
.90	1,450	2.90	2,965	6.80	8,120	14.00	17,840
1.00	1,515	3.00	3,060	7.00	8,390	15.00	19,190
1.10	1,580	3.20	3,275	7.20	8,660	16.00	20,540
1.20	1,647	3.40	3,530	7.40	8,930	17.00	21,890
1.30	1,715	3.60	3,800	7.60	9,200		
1.40	1,785	3.80	4,070	7.80	9,470		

[a] Discharge estimated above gage height, 5.0 feet.
[b] Above gage height 3.40 the rating curve is a tangent, the difference being 135 per tenth.

Rating tables for Chattahoochee River at Oakdale—Continued.

JANUARY 1 TO JUNE 30, 1898.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−0.20	920	1.80	2,130	3.80	3,830	7.00	9,000
.10	970	1.90	2,200	3.90	3,930	7.80	9,300
.00	1,020	2.00	2,270	4.00	4,030	8.00	9,600
.10	1,075	2.10	2,345	4.20	4,250	8.50	10,350
.20	1,130	2.20	2,420	4.40	4,470	9.00	11,100
.30	1,185	2.30	2,495	4.60	4,690	9.50	11,850
.40	1,240	2.40	2,570	4.80	4,920	10.00	12,600
.50	1,295	2.50	2,650	5.00	5,160	10.50	13,350
.60	1,350	2.60	2,730	5.20	5,420	11.00	14,100
.70	1,405	2.70	2,815	5.40	5,700	12.00	15,600
.80	1,470	2.80	2,900	5.60	6,000	13.00	17,100
.90	1,530	2.90	2,985	5.80	6,300	14.00	18,600
1.00	1,590	3.00	3,070	6.00	6,600	15.00	20,100
1.10	1,650	3.10	3,160	6.20	6,900	16.00	21,600
1.20	1,720	3.20	3,250	6.40	7,200	17.00	23,100
1.30	1,785	3.30	3,340	6.60	7,500	18.00	24,600
1.40	1,850	3.40	3,430	6.80	7,800	19.00	26,100
1.50	1,920	3.50	3,530	7.00	8,100	20.00	27,600
1.60	1,990	3.60	3,630	7.20	8,400		
1.70	2,060	3.70	3,730	7.40	8,700		

JULY 1, 1898, TO MAY 31, 1899.[b]

0.70	730	3.80	3,050	7.20	7,260	13.00	14,800
.80	780	4.00	3,250	7.40	7,520	14.00	16,100
.90	840	4.20	3,450	7.60	7,780	15.00	17,400
1.00	900	4.40	3,650	7.80	8,040	16.00	18,700
1.20	1,020	4.60	3,900	8.00	8,300	17.00	20,000
1.40	1,150	4.80	4,150	8.20	8,560	18.00	21,300
1.60	1,280	5.00	4,400	8.40	8,820	19.00	22,600
1.80	1,420	5.20	4,660	8.60	9,080	20.00	23,900
2.00	1,560	5.40	4,920	8.80	9,340	21.00	25,200
2.20	1,700	5.60	5,180	9.00	9,600	22.00	26,500
2.40	1,850	5.80	5,440	9.20	9,860	23.00	27,800
2.60	2,000	6.00	5,700	9.40	10,120	24.00	29,100
2.80	2,150	6.20	5,960	9.60	10,380	25.00	30,400
3.00	2,300	6.40	6,220	9.80	10,640	26.00	31,700
3.20	2,470	6.60	6,480	10.00	10,900	27.00	33,000
3.40	2,650	6.80	6,740	11.00	12,200	28.00	34,300
3.60	2,850	7.00	7,000	12.00	13,500		

JUNE 1, 1899, TO DECEMBER 31, 1900.[c]

0.10	870	1.30	1,560	2.50	2,540	3.70	3,720
.20	910	1.40	1,630	2.60	2,630	3.80	3,825
.30	950	1.50	1,700	2.70	2,720	3.90	3,930
.40	1,000	1.60	1,780	2.80	2,810	4.00	4,035
.50	1,050	1.70	1,860	2.90	2,905	4.20	4,250
.60	1,100	1.80	1,940	3.00	3,000	4.40	4,470
.70	1,160	1.90	2,020	3.10	3,100	4.60	4,700
.80	1,220	2.00	2,100	3.20	3,200	4.80	4,930
.90	1,280	2.10	2,185	3.30	3,300	5.00	5,160
1.00	1,350	2.20	2,270	3.40	3,405		
1.10	1,420	2.30	2,360	3.50	3,510		
1.20	1,490	2.40	2,450	3.60	3,615		

[a] Above gage height 5.40 the rating curve is a tangent, the difference being 150 per tenth.
[b] Applies only to the gage heights recorded from the lower gage at Mason and Turners Ferry. Above 1 feet the rating curve is a tangent, the difference being 130 per tenth.
[c] Above gage height 5.0 feet the above table is the same as the table used from January 1 to June 30, 1898.

Rating tables for Chattahoochee River at Oakdale—Continued.

JANUARY 1 TO DECEMBER 31, 1901.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	1,680	3.50	3,210	5.40	5,256	8.60	8,904
1.70	1,758	3.60	3,305	5.50	5,370	8.80	9,132
1.80	1,827	3.70	3,402	5.60	5,484	9.00	9,360
1.90	1,898	3.80	3,500	5.70	5,598	9.20	9,588
2.00	1,970	3.90	3,600	5.80	5,712	9.40	9,816
2.10	2,044	4.00	3,702	5.90	5,826	9.60	10,044
2.20	2,119	4.10	3,805	6.00	5,940	9.80	10,272
2.30	2,195	4.20	3,909	6.20	6,168	10.00	10,500
2.40	2,272	4.30	4,014	6.40	6,396	10.50	11,070
2.50	2,350	4.40	4,121	6.60	6,624	11.00	11,640
2.60	2,430	4.50	4,230	6.80	6,852	11.50	12,210
2.70	2,511	4.60	4,344	7.00	7,080	12.00	12,780
2.80	2,593	4.70	4,458	7.20	7,308	12.50	13,350
2.90	2,676	4.80	4,572	7.40	7,536	13.00	13,920
3.00	2,760	4.90	4,686	7.60	7,764	13.50	14,490
3.10	2,846	5.00	4,800	7.80	7,992	14.00	15,060
3.20	2,934	5.10	4,914	8.00	8,220	14.50	15,630
3.30	3,024	5.20	5,028	8.20	8,448		
3.40	3,116	5.30	5,142	8.40	8,676		

JANUARY 1 TO DECEMBER 31, 1902.[b]

0.50	950	1.60	1,620	2.70	2,415	3.80	3,450
.60	1,005	1.70	1,685	2.80	2,500	3.90	3,555
.70	1,060	1.80	1,750	2.90	2,585	4.00	3,665
.80	1,120	1.90	1,820	3.00	2,675	4.10	3,775
.90	1,180	2.00	1,890	3.10	2,765	4.20	3,885
1.00	1,240	2.10	1,960	3.20	2,855	4.30	4,000
1.10	1,300	2.20	2,030	3.30	2,950	4.40	4,115
1.20	1,360	2.30	2,105	3.40	3,045	4.50	4,230
1.30	1,425	2.40	2,180	3.50	3,145		
1.40	1,490	2.50	2,255	3.60	3,245		
1.50	1,555	2.60	2,335	3.70	3,345		

JANUARY 1, 1903, TO DECEMBER 31, 1904.

0.80	1,180	2.30	2,170	3.80	3,450	11.00	11,340
.90	1,240	2.40	2,245	3.90	3,545	12.00	12,540
1.00	1,300	2.50	2,320	4.00	3,640	13.00	13,840
1.10	1,360	2.60	2,400	4.50	4,140	14.00	15,140
1.20	1,420	2.70	2,480	5.00	4,640	15.00	16,540
1.30	1,480	2.80	2,560	5.50	5,140	16.00	17,940
1.40	1,545	2.90	2,645	6.00	5,640	17.00	19,400
1.50	1,610	3.00	2,730	6.50	6,190	18.00	20,980
1.60	1,675	3.10	2,815	7.00	6,740	19.00	22,800
1.70	1,740	3.20	2,900	7.50	7,290	20.00	25,000
1.80	1,810	3.30	2,980	8.00	7,840	21.00	27,800
1.90	1,880	3.40	3,080	8.50	8,390	22.00	31,300
2.00	1,950	3.50	3,170	9.00	8,940	23.00	34,800
2.10	2,020	3.60	3,260	9.50	9,540	24.00	38,300
2.20	2,095	3.70	3,355	10.00	10,140	25.00	41,800

[a] Between gage heights 4.50 and 14.0 feet the rating curve is a tangent, the difference being 114 per tenth. Above gage height 14.0 feet the 1904 rating curve has been used to obtain revised estimates for 1901.

[b] Between gage heights 4.5 and 14.0 feet the above table is the same as the 1901 table. Above gage height 14.0 feet the 1904 rating curve has been used to obtain revised estimates for 1902.

Estimated monthly discharge of Chattahoochee River at Oakdale.

[Drainage area, 1,560 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1895.					
r 15 to 31	1,180	970	1,038	0.67	0.43
ber	1,961	1,130	1,293	.83	.92
ber	2,911	1,140	1,432	.92	1.06
1896.					
y	12,000	1,356	2,821	1.81	2.09
ry	7,400	1,707	2,767	1.77	1.90
	2,120	1,586	1,790	1.15	1.33
	2,740	1,328	1,599	1.02	1.14
	3,088	1,060	1,384	.89	1.02
	2,227	875	1,272	.82	.01
	24,600	821	3,891	2.50	2.89
	1,961	821	1,075	.69	.79
ber	1,300	745	850	.54	.60
r	1,469	775	913	.58	.67
ber	4,640	1,086	1,608	1.03	1.15
ber	3,133	1,112	1,454	.93	1.07
he year	24,600	745	1,785	1.14	15.56
1897.					
y	9,065	1,035	2,575	1.65	1.90
ry	6,965	2,150	3,734	2.39	2.49
	15,950	2,075	5,658	3.63	4.19
	21,890	2,226	5,147	3.30	3.68
	4,475	1,515	2,130	1.37	1.58
	1,801	1,091	1,438	.92	1.02
	15,545	1,177	3,360	2.15	2.48
	2,965	1,007	1,452	.93	1.07
ber	1,206	725	845	.54	.60
r	1,855	675	979	.63	.72
ber	2,113	876	1,078	.69	.77
ber	3,013	1,206	1,845	1.18	1.36
he year	21,890	675	2,520	1.62	21.86
1898.					
y	9,150	1,295	2,288	1.47	1.69
ry	1,920	1,240	1,450	.93	.97
	10,200	1,185	1,984	1.27	1.46
	14,325	1,688	3,425	2.20	2.45
	2,165	1,158	1,566	1.00	1.15
	2,095	920	1,181	.76	.84
	14,020	730	2,806	1.80	2.08
	18,700	1,490	4,774	3.06	3.53
ber	33,975	1,925	7,434	4.77	5.31
r	28,450	1,850	6,096	3.91	4.51
ber	4,530	2,150	2,889	1.92	2.14
ber	8,950	2,112	3,179	2.09	2.35
he year	33,975	730	3,256	2.09	28.48
1899.					
y	6,675	2,385	3,712	2.38	2.75
ry	26,695	3,350	8,511	5.46	5.68
	29,425	4,337	9,178	5.88	6.77
	14,800	3,962	5,931	3.80	4.24
	5,800	2,385	3,280	2.10	2.43
	4,930	1,740	2,310	1.48	1.65
	6,450	1,220	1,948	1.25	1.44
	5,420	870	1,506	.97	1.12
ber	4,700	910	1,413	.91	1.01
r	2,100	870	1,175	.75	.86
ber	3,000	1,000	1,408	.90	1.00
ber	7,200	1,160	2,242	1.44	1.66
he year	29,425	870	3,551	2.28	30.61
1900.					
y	6,300	1,050	2,275	1.46	1.68
ry	28,650	1,280	5,929	3.80	3.95
	10,800	3,000	5,137	3.29	3.79
	18,000	2,630	5,484	3.52	3.92
	5,160	2,450	3,295	2.11	2.44
	24,600	3,000	8,207	5.26	5.87
	12,600	3,720	5,847	3.75	4.32
	5,160	2,540	3,275	2.10	2.43
ber	12,900	1,700	3,277	2.10	2.34
r	4,340	2,185	3,234	2.07	2.39
ber	6,000	1,700	2,436	1.56	1.74
ber	4,140	2,100	2,753	1.76	2.03
he year	28,650	1,050	4,262	2.73	36.90

Estimated monthly discharge of Chattahoochee River at Oakdale—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.[a]					
January	31,300	2,044	5,536	3.55	4.[illegible]
February	5,028	2,272	3,214	2.06	2.[illegible]
March	36,550	2,044	5,303	3.40	3.[illegible]
April	12,780	2,846	5,149	3.30	3.[illegible]
May	25,000	2,511	4,781	3.06	3.[illegible]
June	10,500	2,934	4,749	3.04	3.[illegible]
July	9,474	2,040	3,225	2.07	2.[illegible]
August	24,500	1,829	7,847	5.03	5.[illegible]
September	15,980	2,676	4,153	2.66	2.[illegible]
October	4,344	1,758	2,600	1.67	1.[illegible]
November	1,898	1,090	1,763	1.13	1.[illegible]
December	48,800	1,090	5,583	3.58	4.[illegible]
The year	48,800	1,090	4,492	2.88	39.[illegible]
1902.[a]					
January	9,588	1,960	2,881	1.85	2.[illegible]
February	35,500	2,415	5,788	3.71	3.[illegible]
March	41,800	3,245	8,984	5.76	6.[illegible]
April	7,194	3,045	4,065	2.61	2.[illegible]
May	3,450	2,765	3,150	2.02	2.[illegible]
June	5,484	2,335	3,004	1.93	2.[illegible]
July	3,245	1,750	2,113	1.35	1.[illegible]
August	2,415	1,555	1,786	1.14	1.[illegible]
September	8,106	1,890	2,938	1.88	2.[illegible]
October	1,960	950	1,470	.94	1.[illegible]
November	4,572	950	1,481	.95	1.[illegible]
December	8,904	1,620	3,032	1.94	2.[illegible]
The year	41,800	950	3,391	2.17	29.[illegible]
1903.					
January	4,540	1,880	2,570	1.65	1.[illegible]
February	43,900	2,480	9,710	6.22	6.[illegible]
March	36,200	4,240	11,501	7.37	8.[illegible]
November	2,730	1,300	1,567	1.00	1.[illegible]
December	1,740	1,300	1,483	.95	1.[illegible]
1904.					
January	3,640	1,480	1,993	1.28	1.[illegible]
February	7,510	1,610	2,504	1.61	1.[illegible]
March	8,060	1,810	2,749	1.76	2.[illegible]
April	4,640	1,610	1,983	1.27	1.[illegible]
May	4,140	1,180	1,699	1.09	1.[illegible]

[a] Estimates revised above gage height 14.0 feet on the basis of the 1904 rating curve.

CHATTAHOOCHEE RIVER AT WEST POINT.

This station was established July 30, 1896, by M. R. Hall, and the gage is now maintained by the United States Weather Bureau. It is located at the Montgomery street wagon bridge.

The channel is straight for about 2,000 feet above and 3,000 feet below the station. The current has a fair velocity, except at low stages. The right bank is high and overflows only at high water, when most of the town is covered. The left bank is somewhat lower and overflows for about 800 feet at a gage height of 20 feet. The bed of the stream is of sand and gravel and is unstable

The bridge from which discharge measurements are made is in three spans, with short approaches from each end. The floor of the bridge is about 24 feet above low water. The initial point for sound-

ings is the end of the hand rail on the right bank, downstream side of the bridge. A standard chain gage is fastened to the outside of the iron railing of the downstream footway at a point 122 feet from the initial point for soundings; length of chain, 29.26 feet. Bench marks were established as follows: (1) The top of the downstream end of the second iron floor beam under the bridge floor from the right-bank end of the bridge; elevation, 24.19 feet. (2) The top of the thirty-eighth milepost on the Franklin and West Point survey of the United States Engineers. This post is a cast-iron cap 6 inches square, set in concrete, approximately on a level with the ground, and marked "U. S. 38." A raised point in the center of the cap is the bench mark; elevation, 15.68 feet. The location of this post is on the right bank of the river, 340 feet upstream from the wagon bridge and 50 feet from the edge of the river and 60 feet south of the Episcopal Church.

Discharge measurements of Chattahoochee River at West Point.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
1895.		
October 22	1.76	1,404
1896.		
June 29		2,067
July 30	2.45	2,430
August 14	1.72	1,594
September 5	1.20	1,006
September 25	1.15	1,030
October 28	1.75	1,642
1897.		
January 23	6.66	11,920
April 26	3.70	5,448
May 4	4.13	6,230
May 19	3.00	3,557
June 5	2.90	3,253
June 19	2.59	2,934
July 8	3.03	3,470
July 23	5.01	7,853
August 14	2.12	1,915
September 4	1.80	1,690
September 22	1.20	985
November 9	1.71	1,345
November 23	1.60	1,322
December 17	3.14	3,989
1898.		
January 18	2.45	2,648
February 18	2.43	2,464
March 17	3.03	3,571
April 6	9.20	19,890
April 21	2.90	2,723
April 26	4.52	6,704
May 17	2.15	1,975
June 11	1.40	1,161
July 6	2.27	2,451
August 5	8.82	18,510
September 2	7.55	15,070
September 3	11.25	25,200
October 5	13.90	37,580
October 29	3.38	4,409
November 29	4.00	5,394
1899.		
March 14	5.30	8,726
April 24	4.72	7,144
May 13	3.80	4,828
June 26	3.06	3,234
September 12	3.10	3,689
October 18	2.07	2,088
December 16	3.49	4,111
1900.		
January 20	4.65	6,574
February 24	4.92	7,158
August 22	2.80	2,755
December 4	3.93	5,224
1901.		
March 12	4.34	6,007
August 6	3.00	3,435
October 28	2.80	2,910
1902.		
January 15	3.50	4,364
July 25	2.00	1,916
1903.		
January 6	3.95	5,056
April 22	5.39	8,713
June 5	9.70	20,960
June 6	11.30	25,620
July 30	3.46	4,761
July 31	4.07	5,993
September 23	2.40	2,451
September 24	2.32	2,416
September 17	2.37	2,460
1904.		
February 3–4	2.80	3,005
April 7	2.83	3,144
April 7	2.88	3,155
April 14	2.90	3,179
April 14	2.90	3,180
June 20	1.56	1,298
June 20	1.56	1,306
September 2	1.46	1,203
September 3	2.00	1,862
September 29	1.20	1,005
September 30	1.27	1,010
December 6	2.70	2,808
1905.		
March 24	3.28	4,026
June 6	2.30	2,048
October 28	2.30	2,252

Daily gage height, in feet, of Chattahoochee River at West Point.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	De
1896.						1896.					
1	2.7	1.3	4.1	1.7	4.2	17	1.6	0.85	1.1	3.0	
2	3.9	1.2	4.0	2.0	4.0	18	1.55	.8	1.1	2.6	
3	4.5	1.1	3.0	3.25	3.75	19	1.5	.8	1.1	2.5	
4	6.0	1.05	2.6	8.0	3.6	20	1.45	.8	1.1	2.4	
5	5.5	1.0	2.4	9.2	3.4	21	1.4	.8	1.15	2.25	
6	5.0	1.0	2.0	7.6	3.2	22	1.4	3.3	1.1	2.25	
7	3.65	1.0	1.9	5.5	3.1	23	1.3	3.0	1.5	2.2	
8	3.2	1.05	1.5	4.3	3.1	24	1.2	2.5	1.75	2.2	
9	2.75	1.1	1.3	3.45	3.05	25	3.0	2.0	1.75	2.9	
10	2.6	1.05	1.25	2.8	3.0	26	2.0	1.7	1.7	1.9	
11	2.2	.95	1.25	2.0	2.9	27	1.8	1.6	1.65	1.8	
12	2.0	.85	1.2	2.15	2.8	28	1.75	1.4	1.6	2.0	
13	1.85	.85	1.15	6.3	2.65	29	1.6	3.6	1.5	4.0	
14	1.7	.9	1.15	5.0	2.5	30	1.5	4.2	1.5	4.3	
15	1.6	.9	1.15	4.5	3.0	31	1.4	.....	1.45	.....	
16	1.6	.85	1.15	3.3	3.1						

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	De
1897.												
1	1.9	3.15	3.65	4.0	3.9	2.65	1.9	2.9	1.8	1.1	1.3	
2	1.9	4.4	3.6	4.0	4.0	2.7	4.9	3.0	1.7	1.1	1.3	
3	1.9	7.0	3.5	3.95	3.8	2.8	2.0	3.2	1.65	1.05	1.3	
4	1.95	7.4	3.5	4.4	3.75	2.85	2.3	2.8	1.65	1.05	1.5	
5	2.0	7.1	3.6	8.5	3.65	2.9	3.0	2.8	1.6	1.0	2.1	
6	2.0	6.0	4.1	10.2	3.6	2.95	3.5	2.5	1.6	1.0	2.0	
7	2.0	6.0	10.95	11.0	3.6	2.8	2.5	2.4	1.5	1.0	1.8	
8	1.95	5.2	9.3	10.5	3.6	2.7	3.0	2.2	1.5	.95	1.65	
9	1.95	5.0	7.1	8.0	3.55	2.6	3.0	2.0	1.4	.95	1.7	
10	1.9	4.7	5.5	7.1	3.5	2.6	2.9	1.9	1.4	.95	1.9	
11	1.9	4.9	5.3	6.5	3.5	2.65	2.9	2.9	1.4	1.15	1.9	
12	1.95	7.12	6.2	6.3	3.55	2.65	2.8	3.0	1.35	1.5	1.7	
13	1.95	6.5	10.7	6.0	3.75	2.6	2.4	2.7	1.35	3.0	1.7	
14	2.1	6.1	14.1	5.8	3.6	2.5	2.2	2.3	1.3	2.9	1.6	
15	2.2	4.7	12.9	5.7	3.4	2.45	2.0	2.25	1.3	2.5	1.6	
16	4.0	4.65	11.0	5.5	3.2	2.4	1.8	2.0	1.3	1.9	1.6	
17	4.05	4.6	10.9	5.3	3.1	2.5	1.9	2.95	1.25	1.75	1.5	
18	3.35	4.5	10.0	5.0	3.0	2.9	2.9	3.5	1.25	1.65	1.5	
19	3.3	4.5	9.0	4.5	3.0	2.7	3.0	4.0	1.2	1.6	1.55	
20	3.4	4.35	8.5	4.2	2.9	2.6	9.0	4.5	1.2	1.4	1.4	
21	3.2	4.35	8.3	4.2	2.85	2.55	11.4	6.2	1.2	1.5	1.3	
22	3.3	4.4	8.1	4.1	2.8	2.55	8.0	8.1	1.2	1.6	1.2	
23	6.5	4.85	8.0	4.0	2.75	2.5	5.4	7.0	1.2	1.4	1.1	
24	4.8	5.6	8.5	3.8	2.7	2.5	4.4	6.1	1.2	1.4	1.05	
25	3.7	5.5	7.6	3.85	2.7	2.5	4.2	3.5	1.15	1.3	1.05	
26	3.5	4.0	5.0	3.7	2.7	2.6	4.1	2.8	1.15	1.3	1.1	
27	3.2	3.9	4.95	3.65	2.7	2.3	4.0	2.4	1.15	1.2	1.9	
28	3.0	3.8	4.7	3.6	2.65	2.15	3.6	2.1	1.1	1.2	2.65	
29	3.0	.....	4.5	3.6	2.65	2.0	3.5	2.1	1.1	1.4	2.6	
30	2.95	.....	4.3	3.8	2.65	1.9	3.0	1.9	1.1	1.4	2.5	
31	3.2	.....	4.0	.....	2.65	.....	2.8	1.9	.....	1.3	.....	
1898.												
1	2.4	3.05	2.3	6.3	3.2	1.7	1.25	3.4	3.75	1.8	3.9	
2	2.35	2.9	2.3	5.1	3.15	1.65	1.15	2.9	3.9	1.85	3.35	
3	2.2	2.8	2.3	3.4	3.15	1.65	1.1	3.0	12.0	2.9	3.35	
4	2.2	2.6	2.8	3.2	3.0	1.65	1.1	6.0	14.5	5.6	3.3	
5	2.2	2.2	3.1	7.0	2.8	1.5	1.05	7.6	15.3	11.0	3.3	
6	2.15	2.2	3.15	9.2	2.6	1.5	2.2	9.15	18.2	14.5	3.45	
7	2.15	2.2	3.0	9.5	2.4	1.45	2.35	8.2	17.5	12.0	3.5	
8	2.15	2.1	2.9	8.2	2.3	1.45	2.7	6.3	9.0	13.0	3.35	
9	2.15	2.1	2.5	6.0	2.3	1.4	3.5	5.1	6.2	10.0	3.6	
10	2.1	2.1	2.2	5.4	2.3	1.4	4.0	4.3	4.5	7.5	3.7	
11	2.15	2.1	2.1	5.0	2.2	1.4	3.3	8.0	4.0	4.1	3.5	
12	3.0	2.1	2.1	3.5	2.2	1.4	3.0	8.4	3.75	3.9	3.35	
13	2.75	2.05	2.1	2.95	2.2	1.6	2.8	6.75	3.6	3.2	3.45	
14	2.6	2.05	2.1	2.8	2.2	1.65	2.7	5.2	3.4	3.2	3.8	
15	2.6	2.0	3.3	2.6	2.15	1.9	3.0	4.6	3.4	3.15	3.9	
16	2.75	2.0	3.2	2.4	2.15	2.0	3.3	4.0	3.4	3.0	3.6	
17	2.9	2.0	3.0	2.4	2.15	1.8	4.0	4.1	3.2	3.0	3.75	
18	2.95	2.1	2.8	2.35	2.15	1.8	3.6	5.0	3.0	5.0	3.0	
19	2.75	2.6	2.6	2.35	2.1	1.7	3.0	4.2	2.4	5.5	3.0	
20	2.7	2.6	2.4	3.0	2.1	1.55	2.7	3.8	2.0	5.4	4.9	

ge height, in feet, of Chattahoochee River at West Point—Continued.

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
2.8	2.5	2.15	2.75	2.1	1.5	2.2	3.5	1.9	4.9	4.8	3.25
3.2	2.5	2.15	2.6	2.1	1.75	2.3	3.4	1.9	4.8	4.3	4.0
2.8	2.5	2.15	4.0	2.0	2.0	2.4	3.3	1.9	4.5	4.0	5.65
2.9	2.5	2.15	7.0	1.9	2.1	4.0	3.25	2.9	4.5	3.7	5.0
2.9	2.45	2.1	5.3	1.85	2.0	7.6	3.2	3.0	4.0	3.7	4.5
3.0	2.4	2.1	4.0	2.5	2.1	5.5	3.2	2.75	3.6	3.7	4.4
6.0	2.3	2.1	3.6	2.0	2.2	4.1	5.6	2.5	3.4	3.65	4.2
5.5	2.3	2.1	3.4	1.8	1.75	4.0	10.6	2.05	3.4	3.6	4.0
4.05	.....	3.2	3.4	1.7	1.5	5.6	5.4	1.9	3.4	3.8	3.8
4.6	.....	4.1	3.2	1.7	1.4	6.0	3.8	1.8	3.38	3.7	3.8
3.1	.....	4.3	.....	1.7	.....	4.2	3.5	.....	3.38	.....	3.75
4.3	4.5	14.5	10.0	4.3	3.6	3.0	2.5	2.4	1.1	2.1	4.4
4.35	4.65	12.7	7.7	4.2	3.3	2.8	2.3	2.0	1.3	2.1	4.3
4.2	10.2	6.5	7.0	4.1	3.2	2.7	2.8	2.9	1.3	1.9	3.4
4.1	8.3	5.8	7.15	3.9	3.1	2.5	2.8	2.4	1.1	1.9	3.4
4.0	7.2	6.4	6.7	3.8	3.0	2.4	2.7	2.1	1.4	1.9	3.4
4.0	5.8	7.0	6.4	3.75	3.0	2.4	2.8	3.0	1.5	1.9	3.2
5.5	9.1	6.1	6.9	3.75	2.9	2.4	2.8	2.9	1.8	1.9	3.1
5.75	13.3	5.6	7.3	3.7	2.8	2.8	2.7	2.0	2.4	1.9	3.1
5.5	13.0	5.2	6.8	3.8	2.8	2.9	2.4	1.9	2.7	1.9	2.9
5.6	9.05	5.0	6.3	4.0	3.0	3.0	2.3	2.9	2.6	1.9	2.6
7.0	6.3	4.9	6.0	3.8	3.1	3.2	2.1	2.5	2.3	1.9	2.4
8.8	5.9	4.85	5.4	3.7	3.2	2.5	2.2	2.1	2.3	1.9	3.5
5.9	5.2	4.9	5.15	3.65	3.8	2.3	2.3	2.4	2.1	1.9	4.0
5.4	4.75	5.0	5.1	3.65	4.0	2.3	2.4	2.6	1.9	1.9	4.6
6.0	5.0	5.1	5.05	3.65	4.1	2.3	2.0	2.8	2.4	2.1	4.1
5.2	5.2	10.5	5.0	3.6	3.6	2.1	2.5	2.4	2.5	2.2	3.6
5.0	5.1	12.3	4.95	3.6	3.1	2.3	3.0	1.6	2.3	2.2	3.1
4.9	4.6	13.5	4.9	3.5	3.0	2.3	3.2	1.6	2.3	2.1	3.0
4.75	4.3	12.1	4.8	3.2	2.9	2.5	2.9	1.6	2.6	2.1	2.8
4.5	4.0	10.75	4.6	3.1	2.8	2.7	2.4	1.5	2.9	2.1	2.8
4.2	3.75	8.2	4.45	3.1	2.8	3.0	2.6	1.7	3.3	2.1	2.8
4.1	3.6	7.5	4.6	3.05	2.6	3.6	2.9	1.9	2.4	1.9	2.8
4.05	3.6	6.9	4.65	3.05	2.5	4.2	3.0	2.3	2.4	2.0	3.2
3.9	3.5	7.2	4.7	4.8	2.7	4.7	3.2	1.1	2.3	2.2	6.0
3.6	3.5	7.0	4.8	4.1	2.9	3.6	3.5	1.2	2.5	3.0	5.7
3.6	3.5	6.5	5.6	3.8	3.4	3.0	2.0	1.2	2.1	3.1	5.6
3.5	10.7	6.2	6.05	3.6	3.5	3.2	2.5	1.2	2.0	3.4	4.1
3.65	15.2	6.15	5.1	3.4	3.2	5.9	3 1	1.3	2.1	3.2	3.6
3.75	.....	6.8	5.0	3.3	3.0	3.3	3.6	1.8	2.1	3.5	3.4
4.0	.....	6.3	4.7	3.25	3.2	2.9	2.9	1.9	2.2	4.2	3.3
4.75	.....	7.15	.....	4.0	.....	2.7	2.1	.....	2.1	.....	3.2
3.0	2.8	5.9	4.1	4.9	3.4	6.3	6.4	4.1	2.6	2.8	3.7
2.8	2.6	4.7	4.1	4.8	3.3	9.4	5.7	6.1	2.5	2.7	3.2
2.5	2.4	4.6	4.05	4.6	3.3	7.8	5.0	4.5	2.5	4.6	3.1
2.5	3.0	5.0	4.05	4.4	3.6	7.0	4.5	3.2	2.6	4.2	3.9
2.4	3.0	4.8	4.0	4.3	5.0	6.5	4.0	3.0	3.8	4.3	4.5
2.8	4.6	4.5	3.95	4.2	4.8	6.2	3.6	2.9	4.0	3.6	5.8
2.9	4.5	4.2	3.9	4.0	4.3	5.4	3.4	2.8	4.2	3.4	5.9
2.8	4.2	5.0	3.9	3.8	5.1	5.0	3.2	2.7	3.7	3.2	4.6
2.8	4.6	8.1	3.85	3.6	8.1	5.1	3.1	2.6	3.5	3.1	3.9
2.7	7.3	7.5	3.8	3.6	8.5	4.2	3.0	2.5	3.4	3.0	3.6
3.4	8.6	6.3	4.9	3.5	5.8	4.0	2.9	2.4	3.4	3.0	3.3
4.7	12.2	5.6	6.1	3.4	4.6	3.6	2.8	2.3	3.6	2.9	3.2
4.4	19.12	4.7	6.7	3.4	6.5	5.4	3.4	2.2	3.8	2.9	3.1
4.7	19.5	4.5	6.0	3.4	3.9	5.0	3.8	2.3	3.7	2.8	4.9
4.9	18.5	4.3	5.5	3.3	4.2	4.8	3.0	9.2	3.2	2.8	4.2
4.6	12.4	4.5	4.2	3.3	6.4	4.5	3.0	12.6	3.0	2.7	3.7
3.7	5.9	4.3	4.0	3.2	6.0	4.3	2.9	8.8	3.0	2.7	3.5
3.4	5.5	4.1	6.0	3.2	7.0	4.1	2.9	8.0	2.9	2.7	3.3
3.9	4.7	5.0	7.7	3.7	8.4	4.0	2.8	5.7	2.9	2.7	3.0
4.6	4.5	5.2	8.5	3.6	6.0	3.8	2.8	4.3	2.8	2.7	5.8
4.8	4.6	5.2	7.4	3.5	4.5	3.6	2.8	3.2	2.8	2.6	6.5
5.1	4.6	6.3	7.0	3.4	3.8	3.5	2.8	3.0	3.0	2.8	6.4
4.2	4.7	6.2	7.5	3.4	4.6	3.8	2.9	2.9	4.6	2.9	6.0
3.8	4.8	5.8	7.0	5.0	16.4	3.7	3.5	2.8	5.0	3.0	5.3
3.7	4.8	6.1	9.2	4.4	17.8	3.6	3.8	2.8	4.9	3.2	4.8

Daily gage height, in feet, of Chattahoochee River at West Point—Continue

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov
1900.											
26	3.3	5.0	6.5	8.0	4.2	14.6	3.6	3.4	2.7	3.4	3.
27	3.2	4.6	5.8	6.0	4.0	12.2	4.0	3.2	2.7	3.2	4
28	3.0	4.9	5.4	4.8	3.6	8.4	6.1	3.0	2.7	3.0	4.
29	3.0	.....	5.3	4.5	3.5	5.6	6.7	2.9	2.6	2.9	5.
30	2.9	.....	5.1	5.2	3.4	6.7	12.6	3.3	2.6	2.8	4.
31	2.9	.....	4.5	.....	3.4	.....	9.2	3.9	.....	2.8	.....
1901.											
1	7.8	4.7	4.7	7.8	4.0	6.7	3.9	3.6	5.8	3.4	2.
2	7.2	4.6	4.6	6.7	4.0	6.0	4.5	3.0	5.6	6.3	2.
3	7.0	4.6	4.4	6.2	4.0	7.1	5.0	2.9	4.6	5.1	2.
4	6.1	12.6	4.2	10.3	4.0	6.9	4.9	2.8	3.9	4.4	2.
5	5.3	13.8	4.0	8.6	4.0	5.8	4.2	2.9	3.8	3.6	2.
6	4.7	10.2	3.9	6.4	3.9	5.5	3.7	3.0	3.8	3.3	2.
7	4.0	6.4	3.7	6.2	3.9	6.4	3.5	4.8	3.6	3.1	2.7
8	3.9	6.3	3.5	6.0	3.9	5.9	3.3	6.4	3.5	3.0	2.
9	3.9	7.0	3.5	5.1	3.9	4.7	3.2	6.0	3.4	2.9	2.
10	3.8	6.5	3.4	4.6	3.8	4.2	3.1	4.0	3.3	2.9	2.
11	5.0	6.2	4.1	4.0	3.8	4.0	3.0	3.9	3.1	2.9	2.
12	13.3	6.0	4.2	3.8	3.8	3.8	3.0	5.3	3.1	2.9	2.
13	15.0	5.4	4.5	5.2	3.8	4.0	3.0	4.2	4.7	3.0	2.
14	14.7	4.8	4.0	10.4	3.7	4.9	2.9	4.0	4.0	3.1	2.
15	12.4	4.5	3.9	8.5	3.9	4.7	2.8	3.8	3.9	3.3	2.
16	6.1	4.4	3.7	6.9	3.8	7.9	3.4	6.8	3.4	3.5	2.
17	5.0	4.3	3.7	6.0	3.8	7.6	6.6	10.4	5.0	3.2	2.
18	6.0	4.2	3.6	5.2	4.0	7.4	3.4	7.6	10.4	3.2	2.
19	5.3	4.2	3.4	6.4	4.2	6.2	3.1	10.1	12.7	3.2	2.
20	4.8	4.0	3.4	7.6	4.5	4.5	6.4	7.8	7.8	3.1	3.0
21	4.6	3.9	3.6	7.0	8.4	4.2	4.2	6.5	4.8	3.0	3.
22	4.4	3.9	3.8	6.2	15.7	4.0	3.9	8.2	4.1	2.8	3.
23	4.3	3.8	4.0	5.5	17.2	3.9	3.7	14.1	3.8	2.8	3.
24	4.2	3.8	4.3	5.0	12.8	3.8	3.2	17.1	3.6	2.8	2.
25	4.1	4.6	4.0	4.8	10.5	3.7	3.0	13.6	3.4	2.8	2.
26	4.0	4.2	3.9	4.6	6.2	3.7	2.9	8.2	3.4	2.7	2.
27	3.9	4.0	9.6	4.4	5.5	4.7	2.8	7.1	3.3	2.7	2.
28	4.0	3.9	12.1	4.2	5.0	4.2	2.8	6.0	3.3	2.7	2.
29	4.9	.....	13.0	4.1	4.3	4.0	3.9	5.8	3.8	2.7	2.
30	4.8	.....	5.9	4.1	5.6	3.8	4.1	5.3	3.5	2.7	2.
31	4.7	.....	7.8	.....	7.0	.....	4.0	5.5	.....	2.7	.....
1902.											
1	19.0	7.7	20.0	14.0	4.0	4.6	2.0	3.1	2.8	3.8	2.0
2	17.6	15.5	17.3	8.3	4.0	3.5	2.0	2.3	2.2	3.2	2.0
3	8.3	17.1	17.6	6.1	4.7	3.3	1.9	2.1	2.1	2.9	2.0
4	7.5	14.9	15.9	5.5	4.4	3.1	2.7	2.0	2.2	2.4	2.0
5	5.1	9.2	8.4	5.3	4.0	2.9	2.5	2.2	3.0	3.0	2.0
6	4.7	7.5	6.7	5.4	3.9	2.9	2.8	2.4	2.8	3.0	5.
7	4.2	5.4	5.9	5.5	3.8	2.8	2.6	3.1	2.4	2.6	4.
8	4.1	5.2	5.6	6.2	3.7	2.8	2.4	2.4	2.0	2.6	3.
9	4.0	4.7	5.4	5.1	3.8	2.7	2.3	2.1	2.3	2.5	3.
10	3.9	4.3	5.2	4.9	4.0	2.7	2.2	1.8	2.6	2.2	2.
11	3.8	4.0	5.0	4.7	3.9	2.7	3.2	2.0	2.2	2.2	2.
12	3.7	4.0	4.9	4.7	3.8	2.6	3.0	1.8	2.2	2.6	2.
13	3.6	4.0	6.3	4.6	3.8	2.6	3.6	2.1	2.3	2.5	2.
14	3.4	3.9	5.9	4.5	3.7	2.6	3.4	2.3	2.3	2.7	2.
15	3.4	4.6	6.1	4.5	3.6	2.6	3.2	2.0	2.5	2.8	2.
16	3.3	5.3	8.7	4.5	4.4	2.5	3.1	1.7	2.5	2.4	2.
17	3.3	4.9	16.2	4.5	4.2	2.5	3.0	2.0	2.3	2.4	2.
18	3.2	4.3	11.4	5.5	3.9	2.9	3.9	2.1	2.0	2.4	2.
19	3.5	4.4	8.8	4.9	3.8	2.7	3.6	1.9	1.9	2.2	2.
20	3.9	4.9	7.0	4.7	3.7	2.8	3.3	1.6	1.9	2.1	2.
21	5.4	4.5	5.5	4.5	3.6	2.9	3.8	1.6	2.0	2.0	2.
22	5.0	4.2	5.3	4.3	3.5	2.8	3.4	1.6	1.9	2.0	2.
23	4.3	4.1	4.9	3.9	3.5	2.7	3.3	1.8	2.1	2.0	2.
24	3.8	4.0	5.1	3.9	3.4	2.5	3.2	1.5	1.9	2.0	2.
25	3.7	4.6	6.0	3.9	3.3	2.4	2.0	1.4	3.0	1.9	2.
26	3.7	4.7	6.2	3.8	3.3	2.3	1.9	1.2	3.3	1.9	5.
27	3.6	4.9	6.1	3.8	3.3	2.3	1.9	1.3	5.3	3.4	4.
28	4.5	18.0	11.4	3.9	3.2	2.2	1.8	1.5	5.0	3.2	4.
29	4.1	.....	14.9	3.9	3.1	2.2	2.0	3.0	4.5	2.7	3.
30	4.4	.....	14.9	4.0	3.0	2.1	2.2	4.1	3.8	2.2	3.0
31	4.9	.....	14.6	.....	2.9	.....	2.4	3.0	.....	2.1	.....

ily gage height, in feet, of Chattahoochee River at West Point—Continued.

y.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
3.												
.....	4.1	3.7	11.6	12.2	4.4	5.7	4.0	3.8	2.2	2.1	2.0	2.2
.....	.....	3.4	11.2	10.2	4.4	6.7	3.7	3.0	2.2	2.1	2.1	2.2
.....	4.1	3.3	11.3	7.0	4.4	6.1	3.5	3.7	2.2	2.0	2.2	2.2
.....	4.1	3.6	7.4	6.4	4.4	8.8	3.6	3.8	2.1	2.0	2.5	2.2
.....	4.1	6.4	7.0	6.1	4.4	9.3	4.1	4.6	2.1	2.0	3.5	2.2
.....	4.0	6.9	6.4	5.7	4.3	10.8	3.8	4.5	2.1	2.0	2.8	2.3
.....	3.8	6.2	6.1	5.5	5.4	11.9	4.0	4.0	2.3	2.0	2.6	2.3
.....	3.6	18.5	5.7	5.4	5.2	11.4	4.0	3.3	2.1	2.0	2.8	2.3
.....	3.4	20.1	5.3	9.2	4.8	6.7	4.3	2.9	2.1	2.5	2.5	2.4
.....	3.3	13.9	6.1	8.0	4.5	6.1	4.0	2.8	2.0	2.2	2.3	2.5
.....	3.3	12.0	7.6	6.8	4.3	5.1	3.7	2.8	2.0	2.1	2.3	2.5
.....	4.1	14.9	9.2	5.7	4.2	6.1	3.7	2.7	2.2	2.1	2.3	2.4
.....	4.2	12.8	10.2	6.2	6.6	5.1	3.6	2.9	2.0	2.0	2.5	2.4
.....	5.2	10.1	8.7	6.9	5.9	4.6	6.4	3.0	2.0	2.0	2.5	2.4
.....	4.2	6.4	6.3	8.2	12.7	4.2	6.1	2.8	3.5	2.0	2.4	2.4
.....	3.8	5.5	5.9	10.1	9.0	4.0	4.5	4.0	4.7	2.0	2.4	2.4
.....	3.6	14.5	5.6	6.3	6.1	3.9	3.7	4.3	5.3	2.5	2.3	2.4
.....	3.5	15.9	5.3	5.6	4.8	3.8	3.4	4.7	4.5	2.5	2.7	2.3
.....	3.3	14.6	5.0	5.3	4.4	3.7	3.2	5.7	3.4	2.4	2.9	2.3
.....	3.2	14.2	4.9	7.2	4.2	3.6	3.1	5.1	3.0	2.3	2.7	2.3
.....	3.2	6.3	5.7	7.2	4.1	3.6	3.0	3.8	2.6	2.3	2.6	2.6
.....	3.2	5.5	8.2	5.7	4.0	3.8	2.9	3.1	2.5	2.2	2.5	2.6
.....	3.1	5.1	13.1	5.1	3.9	3.6	2.9	2.9	2.4	2.1	2.4	2.6
.....	3.1	4.9	14.7	4.9	3.8	3.6	2.9	2.7	2.4	2.0	2.3	2.6
.....	3.2	4.6	14.6	4.7	3.7	3.5	3.1	2.6	2.3	2.0	2.3	2.5
.....	3.2	4.5	15.2	5.1	3.6	4.0	3.0	2.5	2.3	2.0	2.3	3.0
.....	3.2	4.4	14.3	5.0	3.6	4.5	2.8	2.4	2.2	2.0	2.3	3.0
.....	3.5	8.3	6.4	4.9	3.6	5.0	2.7	2.3	2.1	2.0	2.3	2.8
.....	3.7	.....	7.0	4.6	3.6	5.2	2.7	2.3	2.1	2.0	2.2	2.7
.....	3.5	.....	12.0	4.5	3.6	4.7	3.0	2.3	2.1	2.0	2.2	2.5
.....	3.9	.....	13.5	.....	5.5	.....	4.0	2.3	.....	2.0	.....	2.4
4.												
.....	2.4	2.9	3.3	2.9	2.5	3.0	2.5	2.6	2.3	1.2	1.2	1.7
.....	2.3	2.9	3.3	2.9	2.5	3.6	2.3	2.7	1.4	1.2	.9	1.8
.....	2.4	2.9	3.7	2.9	2.4	2.7	2.1	2.5	2.0	1.2	1.1	1.9
.....	2.4	2.8	3.5	2.8	2.4	2.4	2.1	3.3	1.9	1.2	1.5	2.0
.....	2.4	2.8	3.3	2.7	2.4	2.2	1.7	2.5	1.8	1.1	1.7	2.0
.....	2.3	2.8	3.1	2.7	2.4	2.1	1.9	3.1	2.5	1.1	1.6	2.6
.....	2.3	3.1	4.7	2.8	2.4	1.5	1.6	5.3	2.4	1.2	1.6	3.0
.....	2.4	4.8	6.0	3.2	2.4	1.4	1.3	11.4	2.2	1.2	1.5	3.2
.....	2.4	5.0	6.0	3.6	2.4	2.0	2.4	12.6	2.1	1.1	1.6	3.1
.....	2.7	4.4	5.4	3.5	3.1	2.3	2.1	12.4	1.9	1.1	1.5	2.5
.....	3.0	5.4	4.2	3.5	3.4	2.1	1.8	9.6	1.7	1.1	1.5	2.2
.....	2.8	5.1	3.7	3.4	3.1	2.0	1.6	6.2	1.6	1.1	1.5	2.1
.....	2.7	4.1	3.6	3.1	2.6	1.8	1.6	4.8	1.6	1.2	1.6	1.9
.....	2.7	3.7	3.6	2.9	2.4	1.6	1.8	4.2	1.6	1.1	1.7	2.0
.....	2.7	3.4	4.0	2.8	2.3	1.6	1.9	5.0	1.5	1.0	1.8	1.8
.....	2.6	3.3	4.2	2.7	2.3	1.6	1.4	4.0	1.5	1.0	1.7	1.8
.....	3.5	3.2	3.7	2.7	2.3	1.6	1.4	3.9	1.4	1.0	1.6	1.8
.....	3.6	3.0	3.4	2.7	2.3	1.5	1.7	3.4	1.4	1.1	1.6	1.8
.....	3.3	3.1	3.2	2.7	2.2	1.5	1.4	3.0	1.4	1.0	1.6	1.8
.....	3.1	3.7	3.1	2.7	2.1	1.5	2.0	2.9	1.3	1.1	1.6	1.8
.....	2.8	4.0	3.0	2.7	2.0	1.5	1.7	2.3	1.3	1.2	1.6	1.7
.....	3.3	5.4	3.0	2.7	2.0	1.4	2.0	2.4	1.4	.9	1.6	1.7
.....	5.5	6.4	3.3	2.7	2.0	1.3	2.1	2.2	1.8	.9	1.8	1.7
.....	5.1	6.1	3.3	2.6	1.9	1.7	2.3	2.2	1.9	.9	1.8	1.7
.....	4.2	5.3	3.8	2.6	1.9	1.3	2.0	4.3	1.5	.9	1.8	1.9
.....	3.8	4.3	3.8	2.6	1.9	1.4	1.9	5.1	1.4	.9	1.8	2.1
.....	3.3	3.9	3.6	2.6	1.8	1.3	1.4	4.1	1.3	1.1	1.7	2.1
.....	3.0	3.6	3.3	2.6	1.8	1.2	1.9	5.8	1.3	1.2	1.7	3.5
.....	3.0	3.4	3.2	2.6	1.8	1.4	1.7	3.9	1.3	1.1	1.7	3.6
.....	2.9	.....	3.1	2.6	1.8	2.0	2.1	3.0	1.3	1.0	1.6	3.7
.....	2.9	.....	3.0	.....	2.7	.....	2.2	2.4	.....	1.1	.....	3.6
5.												
.....	2.9	2.6	3.6	2.7	3.3	2.8	2.8	2.2	1.9	[a]1.9	[a]1.88	[a]2.15
.....	2.6	2.5	3.5	2.7	2.5	2.5	4.4	2.0	1.8	3.6	1.85	1.98
.....	2.3	2.4	3.4	2.7	2.7	2.4	7.8	1.3	2.2	2.7	1.85	10.6
.....	2.3	2.4	3.3	2.5	3.0	2.3	4.9	2.0	2.5	2.1	1.85	13.6
.....	2.3	2.7	3.2	2.8	2.9	2.3	3.2	1.9	2.9	1.8	1.9	10.2

[a] October 1 to December 31 two readings a day were made; before that only one reading.

Daily gage height, in feet, of Chattahoochee River at West Point—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1905.											
6	2.2	3.0	3.2	2.9	2.9	2.1	2.9	1.6	2.2	1.7	1.85
7	2.6	3.2	3.1	2.9	3.1	2.1	3.9	1.5	2.0	1.6	1.76
8	2.8	4.0	3.1	2.9	2.9	2.1	4.9	1.5	1.8	1.7	1.95
9	2.6	8.5	3.1	2.9	4.3	2.1	7.8	2.6	1.7	1.5	1.88
10	3.0	8.3	3.6	3.3	4.0	2.0	4.8	2.7	1.7	1.8	2.0
11	2.7	7.3	3.3	3.2	3.9	1.9	4.2	3.0	1.6	2.35	2.8
12	3.4	7.0	3.1	3.2	3.3	1.7	5.8	4.1	1.6	2.7	3.0
13	12.6	9.2	3.6	3.1	3.0	1.6	8.7	5.2	1.8	2.35	2.5
14	10.6	8.9	3.6	2.9	2.7	1.6	8.2	5.5	1.7	2.9	2.1
15	10.2	8.5	3.3	2.8	2.5	1.9	5.4	4.6	1.7	2.5	2.1
16	5.5	6.1	3.2	3.0	2.4	2.2	3.9	6.2	1.6	2.1	2.1
17	4.0	4.8	3.1	3.0	2.8	2.5	3.7	4.7	1.5	2.0	2.0
18	3.6	4.3	3.1	2.5	3.0	2.2	3.2	4.4	1.6	1.8	2.0
19	3.4	3.9	3.0	2.6	3.7	2.9	2.8	3.5	1.5	1.8	2.0
20	3.3	3.8	3.0	2.6	3.0	2.4	2.5	2.8	1.6	1.9	2.05
21	3.2	4.5	3.5	2.6	2.9	2.4	2.7	2.6	1.4	1.7	1.98
22	3.1	6.9	3.6	2.7	2.8	2.3	2.0	2.2	1.3	1.7	2.0
23	3.0	9.3	3.3	2.8	2.9	2.5	2.5	2.8	1.3	1.65	1.95
24	2.7	6.0	3.4	2.8	4.1	2.5	2.3	3.4	1.3	1.72	1.93
25	2.7	4.9	3.1	2.4	4.0	2.6	2.3	4.0	1.5	1.85	1.95
26	2.6	4.4	3.0	2.6	5.0	2.9	2.7	3.7	1.4	2.8	1.98
27	2.3	4.0	3.0	2.6	4.1	2.2	2.5	3.0	1.3	2.7	2.0
28	2.3	3.8	2.8	2.0	3.5	2.2	2.0	2.6	1.3	2.25	2.1
29	2.4	.....	2.8	2.0	3.2	2.4	1.4	2.0	1.3	2.1	2.1
30	2.5	.....	2.8	2.6	3.1	3.1	2.6	2.1	1.5	2.0	2.1
31	2.5	.....	2.7	.....	2.9	.....	2.3	2.0	.....	1.98	.....

Rating tables for Chattahoochee River at West Point.

AUGUST 1, 1896, TO DECEMBER 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	780	2.90	3,170	5.00	8,040	9.50	20,750
.90	820	3.00	3,340	5.20	8,592	10.00	22,200
1.00	870	3.10	3,520	5.40	9,144	10.50	23,650
1.10	930	3.20	3,700	5.60	9,696	11.00	25,100
1.20	1,000	3.30	3,890	5.80	10,248	11.50	26,590
1.30	1,090	3.40	4,080	6.00	10,800	12.00	28,800
1.40	1,180	3.50	4,280	6.20	11,352	12.50	31,110
1.50	1,280	3.60	4,480	6.40	11,904	13.00	33,410
1.60	1,380	3.70	4,700	6.60	12,456	13.50	35,710
1.70	1,490	3.80	4,920	6.80	13,008	14.00	38,030
1.80	1,600	3.90	5,140	7.00	13,560	15.00	42,630
1.90	1,720	4.00	5,370	7.20	14,112	16.00	47,230
2.00	1,840	4.10	5,620	7.40	14,664	17.00	51,830
2.10	1,970	4.20	5,880	7.60	15,240	18.00	56,430
2.20	2,100	4.30	6,140	7.80	15,820	19.00	61,030
2.30	2,240	4.40	6,400	8.00	16,400	20.00	65,630
2.40	2,380	4.50	6,670	8.20	16,980	21.00	70,230
2.50	2,530	4.60	6,940	8.40	17,560	22.00	74,830
2.60	2,680	4.70	7,215	8.60	18,140	23.00	79,430
2.70	2,840	4.80	7,490	8.80	18,720	24.00	84,030
2.80	3,000	4.90	7,765	9.00	19,300	25.00	88,630

[a] Above gage height 14.00 feet the rating curve is a tangent, the difference being 460 per tenth. Be gage height 1.20 feet the above rating table has been revised.

Rating tables for Chattahoochee River at West Point—Continued.

JANUARY 1, 1904, TO DECEMBER 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	800	2.30	2,240	3.70	4,720	6.20	10,840
1.00	850	2.40	2,380	3.80	4,940	6.40	11,580
1.10	920	2.50	2,530	3.90	5,160	6.60	11,940
1.20	1,000	2.60	2,680	4.00	5,380	6.80	12,720
1.30	1,090	2.70	2,840	4.20	5,830	7.00	13,100
1.40	1,180	2.80	3,000	4.40	6,290	8.00	16,000
1.50	1,280	2.90	3,170	4.60	6,760	9.00	18,900
1.60	1,380	3.00	3,340	4.80	7,240	10.00	21,800
1.70	1,490	3.10	3,520	5.00	7,740	11.00	24,700
1.80	1,600	3.20	3,700	5.20	8,240	12.00	27,600
1.90	1,720	3.30	3,890	5.40	8,740	13.00	30,500
2.00	1,840	3.40	4,080	5.60	9,260	14.00	33,400
2.10	1,970	3.50	4,280	5.80	9,780		
2.20	2,100	3.60	4,500	6.00	10,300		

[a] Above gage height 6.5 feet the rating curve is a tangent, the difference being 290 per tenth.

Estimated monthly discharge of Chattahoochee River at West Point.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile	Depth in inches.
1896.[a]					
ıst	10,800	1,000	2,854	0.86	0.99
ember	5,880	780	1,469	.44	.49
ber	5,620	930	1,624	.49	.56
mber	19,900	1,490	5,074	1.54	1.72
mber	5,880	1,720	3,114	.94	1.08
1897.[b]					
ary	17,000	1,720	4,270	1.29	1.49
uary	14,700	3,610	8,532	2.59	2.70
h	38,500	4,280	14,392	4.36	5.03
	25,100	4,480	9,518	2.88	3.21
	5,370	2,760	3,788	1.15	1.33
	3,260	1,720	2,647	.80	.89
	26,500	1,600	5,140	1.56	1.80
ıst	16,700	1,720	4,253	1.29	1.49
ember	1,600	930	1,138	.34	.38
ber	3,340	845	1,290	.39	.45
mber	2,760	900	1,474	.45	.50
mber	6,140	2,380	3,536	1.07	1.23
The year	38,500	845	4,998	1.51	20.50
1898.[c]					
ary	10,800	1,970	3,321	1.01	1.16
uary	3,430	1,840	2,319	.70	.73
h	6,140	1,970	2,785	.84	.97
	20,750	2,310	6,931	2.10	2.34
	3,700	1,540	2,235	.68	.78
	2,100	1,180	1,491	.45	.50
	15,240	900	4,262	1.29	1.49
ıst	23,940	3,170	8,615	2.61	3.01
ember	57,350	1,600	11,080	3.36	3.75
ber	40,330	1,600	9,511	2.88	3.32
mber	10,110	3,890	5,904	1.79	2.00
mber	9,834	3,795	5,272	1.60	1.84
The year	57,350	900	5,311	1.61	21.89

[a] Estimates for 1896 were revised on the basis of the 1898 rating curve.
[b] Estimates for 1897 were revised on the basis of the 1898 rating curve.
[c] Estimates below gage height 1.20 feet for 1898 and 1899 have been revised.

Estimated monthly discharge of Chattahoochee River at West Point—Continue

Month.	Discharge in second-feet.			Run-of	
	Maximum.	Minimum.	Mean.	Sec.-ft. per Sq. mile	
1899.[a]					
January	18,720	4,280	7,483	2.27	
February	43,550	4,280	12,903	3.91	
March	40,330	7,627	15,696	4.76	
April	22,200	6,535	10,157	3.08	
May	7,490	3,430	4,716	1.43	
June	5,625	2,530	3,625	1.10	
July	10,524	1,970	3,419	1.04	
August	4,280	1,840	2,819	.85	
September	3,340	930	1,971	.60	
October	3,890	930	2,085	.63	
November	5,880	1,720	2,303	.70	
December	10,800	2,380	4,685	1.42	
The year	43,550	930	5,989	1.82	
1900.					
January	8,316	2,380	4,554	1.38	
February	63,330	2,380	14,652	4.44	
March	16,690	5,625	8,941	2.71	
April	19,880	4,920	9,563	2.90	
May	8,040	3,700	5,024	1.52	
June	55,510	3,890	13,983	4.24	
July	31,570	4,280	9,277	2.81	
August	11,904	3,000	4,418	1.34	
September	31,570	2,100	6,212	1.88	
October	8,040	2,530	4,094	1.24	
November	8,040	2,680	4,054	1.23	
December	14,112	3,340	6,571	1.99	
The year	63,330	2,100	7,612	2.31	
1901.					
January	42,630	4,920	11,748	3.56	
February	37,100	4,920	10,015	3.03	
March	33,410	4,280	7,952	2.41	
April	23,360	4,920	11,022	3.34	
May	52,750	4,700	10,814	3.28	
June	16,110	4,920	8,487	2.57	
July	12,456	3,000	4,964	1.50	
August	52,290	3,000	12,982	3.93	
September	32,030	3,520	7,145	2.16	
October	11,628	2,840	3,883	1.18	
November	4,280	2,380	2,835	.86	
December	88,630	2,380	12,116	3.67	
The year	88,630	2,380	8,664	2.62	
1902.					
January	61,030	3,700	9,585	2.90	
February	56,430	5,145	13,852	4.20	
March	65,630	7,765	21,982	6.66	
April	38,030	4,920	8,231	2.49	
May	7,215	3,170	4,791	1.45	
June	6,940	1,970	2,962	.90	
July	5,145	1,600	2,988	.91	
August	5,625	1,000	2,061	.62	
September	8,868	1,720	2,963	.90	
October	4,920	1,720	2,603	.79	
November	9,972	1,840	3,460	1.05	
December	22,490	3,170	7,187	2.18	
The year	65,630	1,000	6,889	2.09	
1903.					
January	8,592	3,520	4,708	1.43	
February	66,090	3,890	21,593	6.54	
March	43,550	7,765	19,626	5.95	
April	29,720	6,670	12,345	3.74	
May	32,030	4,480	7,896	2.39	
June	28,340	4,280	9,976	3.02	
July	11,904	2,840	4,782	1.45	
August	9,972	2,240	4,203	1.27	
September	8,868	1,840	2,825	.86	
October	2,530	1,840	1,988	.60	
November	4,280	1,840	2,485	.75	
December	3,340	2,100	2,463	.75	
The year	66,090	1,840	7,908	2.40	

[a] Estimates below gage height 1.20 feet for 1898 and 1899 have been revised.

Estimated monthly discharge of Chattahoochee River at West Point—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile	Depth in inches.
1904.					
ary	9,000	2,240	3,520	1.07	1.23
uary	11,380	3,000	5,447	1.65	1.78
h	10,300	3,340	4,858	1.47	1.70
l	4,500	2,680	3,107	.942	1.05
	4,080	1,600	2,285	.692	.798
	4,500	1,000	1,695	.514	.574
	2,530	1,050	1,705	.517	.596
ust	29,340	2,100	7,515	2.28	2.63
mber	2,530	1,090	1,484	.450	.502
ber	1,000	800	913	.277	.319
mber	1,600	800	1,375	.417	.465
mber	4,720	1,490	2,294	.695	.801
The year	29,340	800	3,016	.914	12.44
1905.					
ary	29,340	2,100	5,363	1.63	1.88
uary	19,770	2,380	8,915	2.70	2.81
h	4,500	2,840	3,733	1.13	1.30
l	3,890	1,840	2,930	.888	.991
	7,740	2,380	3,869	1.17	1.35
	3,520	1,380	2,257	.684	.763
	18,030	1,180	5,724	1.73	1.99
ust	10,840	1,090	3,743	1.13	1.30
ember	3,170	1,090	1,505	.456	.509
ber	4,500	1,280	2,032	.616	.710
ember	3,340	1,556	1,923	.583	.650
mber	32,240	1,816	10,380	3.15	3.63
The year	32,240	1,090	4,365	1.32	17.88

SOQUE RIVER NEAR DEMOREST.

This station was established July 16, 1904, by M. R. Hall. It is ated at Cannon Bridge, on the road from Cornelia to Acorn, 2½ les from Demorest and about 4 miles above the mouth of the river. The channel is curved for 500 feet above and slightly curved for 0 feet below the station. The current is swift. Both banks are gh and wooded; the right overflows during extreme high water. e bed of the stream is composed largely of rock and is permanent. ere is but one channel at all stages. Discharge measurements are de from the single-span wooden wagon bridge, which has a 28-foot proach on the left bank and a 90-foot approach on the right bank. e initial point for soundings is the end of the bridge on the upstream e at the left bank.

The gage is in two sections: The first is a vertical staff, reading m 0 to 10 feet, fastened to the sill and upstream post of the trestle at at the left bank. An additional section, established Septem- 12, 1905, is a vertical staff, reading from 0.7 foot to 6 feet, tened to the stump of an ironwood tree on the right bank about feet above the bridge. The gage is read once each day by Charles nnon. Bench marks were established as follows: (1) The top of upstream end of the right-bank wooden pier, marked with white int; elevation, 21.20 feet. (2) A nail in the stump of the iron- od tree to which the second section of the gage is attached; eleva- n, 6.00 feet. Elevations refer to the datum of the gage.

Discharge measurements of Soque River near Demorest.

Date.	Gage height.	Discharge.	Date.	Gage height.	Dis
1904.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec*
June 8	1.74	182	March 2	2.12	
July 16	1.40	123	May 27	2.41	
August 24	1.81	202	July 19	2.26	
October 28	1.31	102	September 6	1.81	
October 28	1.31	101	September 12	1.81	
November 23	1.58	150	October 23	1.71	

Daily gage height, in feet, of Soque River near Demorest.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	D
1904.							1904.						
1		1.25	1.65	1.4	1.35	1.4	17	1.4	1.8	1.5	1.3	1.4	
2		2.1	1.65	1.35	1.4	1.4	18	1.35	1.8	1.45	1.3	1.4	
3		2.15	1.6	1.35	1.4	1.45	19	1.4	1.75	1.5	1.3	1.4	
4		1.7	2.75	1.35	1.65	1.55	20	1.4	2.2	1.45	1.3	1.4	
5		2.0	2.6	1.35	1.6	3.05	21	1.4	1.75	1.6	1.25	1.4	
6		3.45	2.0	1.35	1.5	2.3	22	3.7	1.7	1.5	1.25	1.45	
7		1.6	1.85	1.4	1.4	1.7	23	1.55	1.6	1.4	1.3	1.6	
8		5.25	2.1	1.4	1.4	1.65	24	1.5	1.65	1.4	1.3	1.65	
9		2.9	1.85	1.35	1.35	1.55	25	2.3	2.3	1.45	1.3	1.5	
10		2.7	1.7	1.4	1.35	1.5	26	1.6	2.35	1.45	1.3	1.45	
11		1.95	1.6	1.35	1.35	1.45	27	1.45	2.4	1.5	1.3	1.4	
12		2.4	1.6	1.35	1.4	1.45	28	1.4	2.1	1.45	1.3	1.4	
13		2.0	1.6	1.35	1.45	1.55	29	1.65	2.0	1.4	1.3	1.4	
14		1.95	1.55	1.35	1.45	1.5	30	1.5	1.75	1.4	1.3	1.4	
15		1.8	1.5	1.3	1.4	1.5	31	2.7	1.7	.....	1.35	.....	
16	1.45	1.85	1.5	1.3	1.4	1.5							

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	D
1905.												
1	1.7	1.75	2.25	1.9	1.9	2.0	8.6	2.0	1.6	1.8	1.75	
2	1.65	1.75	2.2	1.85	1.95	2.0	3.1	1.9	1.9	1.8	1.75	
3	1.65	1.8	2.1	1.85	2.1	2.1	2.3	2.0	1.9	1.85	1.7	
4	1.6	1.8	2.1	1.8	2.0	2.1	2.0	2.0	1.85	1.75	1.7	
5	1.6	1.85	2.05	2.0	1.95	2.1	1.9	1.9	1.85	1.7	1.7	
6	2.25	1.9	2.0	2.0	3.5	2.0	3.9	1.9	1.8	1.7	1.75	
7	2.7	2.0	2.0	1.9	3.35	2.0	3.1	2.7	1.8	1.7	1.7	
8	1.9	2.0	2.0	1.9	2.4	2.0	2.1	2.7	1.8	1.75	1.7	
9	1.85	3.5	2.1	1.85	2.2	2.9	2.1	2.3	1.8	3.5	1.7	
10	1.85	3.4	2.4	1.8	2.1	3.0	3.1	2.8	1.8	2.4	1.75	
11	1.8	3.1	2.15	1.8	2.05	2.6	3.0	4.2	1.8	2.2	1.75	
12	7.4	3.3	2.2	1.85	2.05	2.4	3.5	3.5	1.75	2.0	1.7	
13	3.8	3.4	2.15	1.85	2.0	2.2	2.7	2.6	1.8	1.9	1.7	
14	2.15	3.1	2.1	1.8	1.9	1.95	6.9	2.5	1.8	1.85	1.7	
15	2.1	2.8	2.1	1.8	3.7	1.8	4.3	3.4	1.8	1.8	1.7	
16	2.0	2.6	2.05	1.8	3.4	1.95	4.3	2.1	1.8	1.8	1.7	
17	1.9	2.2	2.05	1.8	2.9	2.1	2.7	2.1	1.75	1.8	1.65	
18	1.9	2.2	2.0	1.8	2.1	2.0	2.3	2.1	1.75	1.8	1.65	
19	1.85	2.1	2.0	1.8	2.05	2.8	2.2	2.1	1.75	1.8	1.7	
20	1.85	7.1	2.0	1.85	2.0	2.6	4.1	2.1	1.8	1.85	1.7	
21	1.8	5.4	2.0	1.8	2.0	2.6	2.7	2.0	1.8	1.8	1.7	
22	1.8	3.1	2.0	1.85	2.1	2.4	2.6	2.0	1.75	1.75	1.7	
23	1.8	2.8	2.0	1.85	4.0	2.2	2.4	2.2	1.75	1.7	1.7	
24	1.75	2.6	1.95	1.8	2.8	2.1	2.1	2.1	1.75	1.7	1.7	
25	1.75	2.5	1.95	1.8	2.4	1.95	2.1	2.1	1.75	1.75	1.75	
26	1.7	2.4	1.95	2.2	2.4	1.85	2.0	2.3	1.8	2.1	1.9	
27	2.0	2.35	1.95	2.0	2.4	1.8	1.95	2.1	1.8	2.0	1.8	
28	1.9	2.25	1.95	1.9	2.2	1.8	2.0	1.95	1.75	1.8	1.75	
29	1.8	.....	1.95	1.95	2.8	1.85	2.1	2.0	1.7	1.8	1.7	
30	1.7	.....	1.9	1.9	2.7	11.9	2.1	1.75	1.8	1.75	1.7	
31	1.7	.....	1.9	.....	2.1	.....	2.1	1.65	.....	1.75	.....	

Rating tables for Soque River near Demorest.

JULY 16 TO DECEMBER 31, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.25	93	1.50	132	1.80	198	2.10	282
1.30	100	1.60	152	1.90	224	2.20	314
1.40	115	1.70	174	2.00	252		

JANUARY 1 TO DECEMBER 31, 1905.[b]

1.60	151	2.50	393	3.30	685	5.00	1,500
1.70	171	2.60	426	3.40	725	6.00	2,000
1.80	193	2.70	460	3.50	770	7.00	2,500
1.90	217	2.80	495	3.60	815	8.00	3,000
2.00	243	2.90	531	3.70	860	9.00	3,500
2.10	271	3.00	568	3.80	905	10.00	4,000
2.20	300	3.10	606	3.90	950	11.00	4,500
2.30	330	3.20	645	4.00	1,000	12.00	5,000
2.40	361						

Discharge estimated above gage height 2.20 feet.
Above gage height 4.0 feet the rating curve is a tangent, the difference being 50 per tenth.

Estimated monthly discharge of Soque River near Demorest.

[Drainage area 112 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
16–31	980	108	218	1.95	1.16
st	1,745	93	322	2.88	3.32
mber	525	115	174	1.55	1.73
ber	115	93	104	.929	1.07
mber	163	108	122	1.09	1.22
nber	666	115	183	1.63	1.88
1905.					
ary	2,700	151	314	2.80	3.23
ary	2,550	182	527	4.71	4.90
	361	217	257	2.29	2.64
	300	193	210	1.88	2.10
	1,000	217	390	3.48	4.01
	4,950	193	455	4.06	4.53
	3,300	217	626	5.59	6.44
st	1,100	161	343	3.06	3.53
mber	217	151	190	1.70	1.90
ber	770	171	222	1.98	2.28
mber	217	161	175	1.56	1.74
nber	2,400	171	474	4.23	4.88
The year	4,950	151	349	3.12	42.18

SWEETWATER CREEK NEAR AUSTELL.[a]

his station was established May 6, 1904, by M. R. Hall. It is ted at the south side of Lithia Springs Park, near Austell.

he channel is straight for about 300 feet above and 200 feet below gage. The current is sluggish above the gage; below it is swift for ut 50 feet at several places, with sluggish water between. Both ks are high and wooded, the right being composed of rock, and are liable to overflow. There is but one channel at all stages. Disrge measurements are made from a boat at low and ordinary

o monthly estimates have been attempted for this station on account of the erratic plotting of ischarge measurements.

stages about 400 yards below the gage. High-water measurements are made from Strickland's wagon bridge, 1½ miles down stream.

The gage is in two sections: The first is an inclined staff, reading to 8 feet, fastened to solid rock on the right bank; the second is a vertical staff, reading from 8 to 16 feet, fastened to a maple tree on the right bank about 100 feet upstream. The gage is read twice each day by J. L. Causey. Bench marks are: (1) A nail in a small maple on the right bank about 200 feet below the gage; elevation, 5.00 feet. (2) A cross cut on a large rock about 10 feet south of the sloping section of the gage; elevation, 10.00 feet. Elevations refer to the datum of the gage.

Discharge measurements of Sweetwater Creek near Austell.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft*	1905.	*Feet.*	*Sec.-ft.*
May 6 [a]	1.68	122	January 18	3.02	227
June 16 [b]	1.15	61	January 18	3.01	220
June 16 [a]	1.20	64	March 7 [e]	2.80	200
July 9 [a]	1.40	85	May 10 [f]	2.13	147
July 29 [a]	2.70	254	May 10 [f]	2.10	138
August 30 [a]	2.35	178	August 16 [g]	4.44	448
August 31 [c]	1.96	122	August 16 [g]	4.44	438
October 1 [d]	1.24	61	October 7 [f]	1.91	122
October 1 [d]	1.28	60	October 7 [f]	1.89	119

[a] Strickland's bridge.
[b] Boat 100 yards below gage.
[c] Wading 100 yards below gage.
[d] 1,000 feet above gage.
[e] 1,000 feet below gage.
[f] At boat landing below gage.
[g] Measurement made one-third mile east of Austell, Ga.

Daily gage height, in feet, of Sweetwater Creek near Austell.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
1						3.4	1.9	1.5	1.9	0.9	0.9	1.65
2						2.5	1.45	1.6	1.7	.65	1.05	1.6
3						1.9	1.3	4.4	1.6	1.05	.95	1.8
4						1.6	1.25	2.9	3.0	.7	1.6	1.85
5						1.5	1.2	3.9	2.65	1.05	1.8	2.5
6						1.5	1.1	3.85	2.05	.75	1.7	3.65
7						1.95	1.05	2.3	1.7	.95	1.4	2.6
8						1.7	1.35	11.9	1.65	.9	1.35	2.25
9						1.45	1.35	16.3	1.6	.65	1.25	2.05
10						1.3	1.15	11.4	1.45	.9	1.25	2.05
11						1.2	1.1	4.95	1.4	.9	1.25	2.2
12						1.2	1.05	6.3	1.3	.85	1.3	2.0
13						1.1	1.15	4.3	1.25	.9	1.65	1.85
14						1.0	.9	3.45	1.25	.95	2.1	1.75
15						1.0	1.0	3.25	1.35	.85	1.75	1.75
16						1.15	1.05	4.55	1.1	.55	1.45	1.8
17						1.0	.55	3.2	.9	1.0	1.4	1.85
18					1.5	1.0	1.0	3.45	1.2	.7	1.35	1.75
19					1.5	1.0	.75	2.4	1.2	.7	1.45	1.8
20					1.45	1.9	.75	1.95	1.05	.85	1.4	1.65
21					1.45	2.8	.75	2.15	1.1	.7	1.45	1.65
22					1.35	3.5	.9	2.0	1.1	.75	1.8	1.6
23					1.3	2.15	1.15	1.95	1.0	.6	2.4	1.7
24					1.3	1.7	.7	2.65	1.15	1.0	2.0	1.65
25					1.25	1.3	1.05	4.05	1.0	.9	1.75	1.65
26					1.15	1.15	1.0	5.5	1.05	.9	1.6	1.65
27					1.2	1.2	.9	7.15	.85	.85	1.45	1.75
28					1.2	2.4	1.25	6.0	1.1	.85	1.6	3.45
29					1.15	5.6	2.5	3.1	1.05	.9	1.5	3.25
30					1.3	2.85	2.2	2.35	.95	.5	1.5	3.2
31					2.55		1.65	2.1		.95		2.5

Daily gage height, in feet, of Sweetwater Creek near Austell—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	2.1	3.0	3.1	2.35	2.75	1.75	4.0	1.8	1.85	7.2	1.85	2.05
2	2.05	2.6	3.0	2.35	2.35	1.7	3.6	1.65	1.95	5.4	1.7	2.45
3	2.1	2.45	3.0	2.35	2.45	1.6	2.55	1.65	2.1	2.8	1.55	9.6
4	2.05	2.55	2.8	2.3	2.55	1.6	2.2	1.65	3.3	2.45	1.75	12.9
5	2.0	2.45	2.8	2.55	2.35	1.65	5.6	1.5	2.7	2.35	1.75	6.7
6	3.3	2.5	2.8	2.9	2.45	1.55	4.6	1.4	2.55	2.05	1.75	4.0
7	2.8	2.55	2.8	2.8	2.1	1.35	7.0	1.7	1.65	1.85	1.75	3.6
8	2.75	4.4	2.8	2.75	2.15	1.45	11.6	1.45	1.55	1.7	1.8	5.8
9	2.55	7.2	2.85	2.8	2.4	1.25	8.6	1.8	1.55	1.6	1.8	10.2
10	2.3	10.2	3.4	2.65	2.1	1.25	8.8	3.1	1.6	1.65	2.6	11.6
11	2.8	8.6	4.0	2.6	1.95	1.05	9.2	3.4	1.1	2.4	3.4	10.4
12	11.2	6.0	4.1	2.6	1.75	1.0	16.7	4.7	1.65	2.35	3.0	6.4
13	14.4	6.5	3.6	2.5	1.65	1.15	10.7	8.2	1.65	2.2	2.5	4.0
14	11.4	6.8	3.2	2.4	1.65	1.45	5.1	4.4	1.7	2.0	2.2	3.4
15	4.7	6.4	3.0	2.55	1.7	1.55	3.4	3.9	1.35	1.95	2.1	3.5
16	3.4	6.0	2.9	2.8	2.85	1.55	2.9	4.4	1.35	2.0	2.0	3.5
17	3.5	5.6	2.8	2.55	4.0	1.45	2.65	3.9	1.45	2.1	1.95	3.6
18	3.0	5.3	2.75	2.5	2.7	1.35	2.3	3.8	1.6	1.4	1.95	3.5
19	3.0	5.2	2.7	2.4	2.05	1.5	2.25	3.6	1.5	1.8	1.95	3.6
20	3.2	6.6	2.85	2.4	1.9	1.95	2.3	2.8	1.4	1.7	2.0	5.2
21	3.0	7.1	3.7	2.3	1.85	1.4	2.1	2.65	1.35	1.75	1.95	6.4
22	2.8	6.9	3.7	2.2	2.45	1.7	2.1	2.85	1.25	1.65	2.05	6.1
23	2.45	5.5	3.1	2.2	2.9	2.3	1.85	3.9	1.25	1.65	1.9	5.7
24	2.4	4.4	2.85	2.2	5.1	2.7	1.75	5.8	1.4	1.65	1.95	5.2
25	2.2	3.7	2.55	2.15	4.5	2.5	2.35	6.5	1.4	1.85	2.1	4.9
26	2.1	3.4	2.5	2.2	3.3	2.1	2.4	4.1	1.35	2.4	2.5	4.4
27	2.25	3.2	2.5	2.2	2.7	2.85	1.9	2.8	1.3	2.4	2.65	4.0
28	2.2	3.2	2.45	2.1	2.4	3.0	1.75	2.05	1.15	2.2	2.6	3.6
29	2.25	.....	2.4	2.5	2.3	3.6	1.9	1.9	1.15	2.0	2.25	3.6
30	2.4	.....	2.5	2.6	2.3	2.7	2.15	1.7	1.65	1.8	2.02	3.4
31	3.2	.....	2.4	.....	2.0	.....	1.8	1.7	.....	1.75	.....	3.4

MULBERRY CREEK NEAR COLUMBUS.

This station was established June 23, 1904, by W. E. Hall. It is located at Mitchells Bridge, about 16 miles north of Columbus and 12 miles south of Hamilton. Mulberry Creek is a tributary of Chattahoochee River, entering it about 6 miles west of the station.

The channel is straight for about 50 feet above and 200 feet below the bridge. The current is rather sluggish above and swift below the station. Both banks are high and not liable to overflow; the right is clean; the left is wooded and covered with brush. The bed of the stream is composed of rock and sand, with but one channel at all stages, broken by one wooden pier. The bottom is very uneven, causing the current to change direction during low water. Discharge measurements are made from the downstream side of the two-span highway bridge, resting upon stone abutments and center wooden pile bent. The initial point for soundings is the left end of the bridge on the downstream side.

Gage heights are determined directly from the bench mark, which is the top of the downstream end of the wooden cap of center pile bent; elevation, 32.00 feet above the datum of the assumed gage.

Discharge measurements of Mulberry Creek near Columbus.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec.-ft.*
June 23	1.40	58	June 17	1.63	77
September 21	1.23	32	June 17	1.63	82
September 21	1.23	33	September 26	1.00	14
			September 26	1.01	17

FLINT RIVER AT MOLINA.

In May, 1897, a station was established on Flint River at the bridg of the Georgia Midland division of the Southern Railway, about hal way from Atlanta to Columbus. The alternate filling and washin out of sand in an eddy about one-half mile below the station s affected the stream that the fluctuations shown by the gage had n fixed relation to the quantity of water flowing in the river. Aft this fact developed the station was abandoned and reestablished ne Woodbury, at the Macon and Birmingham railroad bridge, about miles lower down the river.

The following discharge measurements were made at the Molin station before it was abandoned. They are accurate, and as the are nearly distributed over a period of one year—from May, 1897, t May, 1898 they give a fair idea of the flow of the stream during thi time. Measurement No. 5 shows the lowest discharge and is undoubt edly very near the minimum of this stream for 1897.

Discharge measurements of Flint River at Molina.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1897.	*Feet.*	*Sec.-ft.*	1898.	*Feet.*	*Sec.-ft.*
May 21		641	February 28		4
June 7		707	April 21		8
June 23		697	May 28		3
August 25		2,843			
November 8		264			
December 7		588			

FLINT RIVER NEAR WOODBURY.

Measurements of the flow of Flint River were made during 189 and 1898 at Molina, but the river bed was so shifting that th station was discontinued June 2, 1898. Two measurements wer made in 1899 at the Macon and Birmingham Railroad bridge nea Woodbury, 5 miles below the Molina station. March 29, 1900, gage was put in near this bridge and the station was reestablishe

The channel above and below the station is slightly curved fo 800 feet. Above gage height 10 feet the banks are subject to over flow for a width of 300 or 400 feet, but all water passes beneath th bridge and its approaches. The bridge and its piers are oblique t

the direction of the current, and the bed is rough and irregular and mostly permanent.

Discharge measurements are made from the Macon and Birmingham Railroad bridge. This is a two-span iron bridge, each span being 150 feet long and supported by brick piers. There are wooden trestle approaches about 150 feet long on the right bank and 225 feet long on the left. The initial point for soundings is the end of the iron bridge on the right bank, downstream side.

The gage is in 5-foot sections; the part reading from zero to 10 feet is attached to a willow tree on the left bank about 300 feet above the bridge and 50 feet below Riggins's old ferry; the section reading from 10 to 15 feet is fastened to a sweet-gum tree 50 feet from the left bank and 150 feet upstream from the bridge. This gage was maintained by the Georgia Geological Survey until November 1, 1900, when it was adopted by the United States Weather Bureau. The observer is G. A. Wright, who is paid by the Weather Bureau. Bench marks were established as follows: (1) The top of the downstream end of the second and third crossbeams from the left-bank end of the bridge; elevation, 27.00 feet; (2) a copper plug set in solid rock on the west side of the river about 100 feet from the water and 100 feet upstream from a point opposite the gage; elevation, 16.29 feet. Elevations refer to the datum of the gage, which is 660 feet above sea level.

Discharge measurements of Flint River near Woodbury.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1899.	*Feet.*	*Sec.-ft.*	1903.	*Feet.*	*Sec.-ft.*
June 29	0.80	590	April 22	2.45	2,679
August 29	.50	461	February 12[a]	9.20	16,290
1900.			March 26	5.45	8,861
March 29	2.20	2,329	June 29	1.48	1,591
May 2	2.85	3,220	July 30	.37	503
December 12	.85	998	September 30	.28	387
December 21	4.35	5,423	1904.		
1901.			February 11	2.81	3,095
February 4	4.02	4,901	February 23	3.30	4,114
March 5	1.18	985	March 30	.74	620
May 17	.82	565	July 7	.00	256
August 15	.90	813	August 25	.30	383
September 6	.60	582	October 4[b]	− .25	178
1902.			1905.		
June 30	.00	292	March 10	.91	844
July 16	1.20	1,226	April 21	.52	544
July 31	.12	329	June 3	.03	307
October 6	1.45	1,520	September 19	− .28	173

[a] This is a flood measurement, stage being high for this station. Results considered fairly accurate.
[b] Taken from boat one-half mile above bridge.

Daily gage height, in feet, of Flint River near Woodbury.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
1				1.3	1.9	0.6	2.9	2.5	0.4	0.2	0.4	[illegible]
2				1.2	1.5	.5	2.8	1.7	.7	.1	1.2	[illegible]
3				1.2	1.3	.6	4.5	1.2	.6	.2	2.0	[illegible]
4				1.1	1.4	1.0	4.3	1.0	.4	.5	3.3	[illegible]
5				1.1	1.2	1.4	3.7	1.2	.3	1.5	2.8	[illegible]
6				1.1	1.0	1.6	2.4	.8	.2	1.8	1.3	[illegible]
7				1.0	.9	1.5	1.8	.6	.2	1.2	1.0	[illegible]
8				1.0	.8	1.4	1.4	.5	.2	1.0	.8	[illegible]
9				1.0	.7	1.8	1.1	.4	.1	1.8	.7	[illegible]
10				1.2	.8	1.8	1.0	.4	.1	.7	.6	[illegible]
11				1.3	.6	1.6	.9	.3	.2	.5	.5	[illegible]
12				2.1	.7	1.0	1.6	.3	.2	.5	.6	[illegible]
13				2.4	.7	.7	1.5	.7	.1	.6	.5	[illegible]
14				2.1	.6	.6	1.6	.4	.1	.6	.5	[illegible]
15				1.6	.6	.5	1.3	.3	1.3	.5	.5	[illegible]
16				1.4	.5	1.0	1.0	.4	1.6	.4	.4	[illegible]
17				1.2	.6	4.1	.8	.4	1.5	.4	.5	[illegible]
18				2.0	.5	4.0	.7	.5	1.3	.3	.5	[illegible]
19				4.6	1.0	3.8	.6	.4	1.1	.2	.6	[illegible]
20				5.2	.8	6.0	.5	.3	.8	.2	.5	[illegible]
21				5.8	.7	5.0	.8	.3	.4	.3	.6	[illegible]
22				5.0	.6	2.4	.6	.2	.3	.3	.7	[illegible]
23				2.8	.5	2.0	.5	.1	.3	.6	.6	[illegible]
24				2.6	1.0	9.0	1.1	.2	.2	.9	.7	[illegible]
25				2.4	1.5	8.5	.8	.1	.3	1.0	.7	[illegible]
26				2.2	1.3	8.0	1.0	.3	.2	1.1	1.5	[illegible]
27				1.9	.9	7.0	1.2	.3	.2	.7	1.6	[illegible]
28				1.7	.7	5.9	1.2	.2	.2	.5	1.2	[illegible]
29			2.2	1.5	.6	5.1	1.6	.2	.2	.4	1.0	[illegible]
30			1.9	1.2	.5	4.1	2.4	.3	.1	.4	.8	[illegible]
31			1.6		.5		3.0	.4		.3		[illegible]
1901.												
1	2.7	1.7	1.3	5.0	1.1	2.7	2.1	.8	1.0	.9	.4	[illegible]
2	3.7	1.6	1.2	4.4	1.0	3.0	1.6	.7	1.1	1.4	.5	[illegible]
3	4.7	1.5	1.2	7.6	1.0	2.8	1.5	.7	.9	2.7	.5	[illegible]
4	4.4	3.7	1.2	6.4	1.0	2.5	1.2	.5	.8	1.7	.6	[illegible]
5	3.5	4.8	1.1	5.2	.9	1.9	.9	.4	.6	1.1	.5	[illegible]
6	2.6	5.4	1.1	3.7	.9	1.6	.9	1.0	.6	1.1	.5	[illegible]
7	2.1	4.3	1.0	2.6	.8	1.8	1.6	1.5	.5	.8	.6	[illegible]
8	1.8	3.0	1.0	2.1	.9	2.6	1.1	1.2	.5	.7	.6	[illegible]
9	1.6	3.4	1.0	1.8	.8	3.2	1.1	.9	.5	.6	.5	[illegible]
10	1.5	3.3	1.2	1.6	.8	1.8	1.0	.7	.4	.7	.5	[illegible]
11	1.6	2.8	2.0	1.5	.7	1.4	.8	.6	.4	.6	.6	[illegible]
12	3.3	2.4	1.8	1.4	.7	1.1	.6	.8	.4	.6	.5	[illegible]
13	4.2	2.2	1.5	1.6	.8	1.2	.5	.9	.5	.5	.6	[illegible]
14	4.5	2.0	1.4	2.1	1.0	2.1	.4	.7	.8	.7	.6	[illegible]
15	3.9	1.7	1.2	2.0	1.1	1.8	.4	.9	1.0	.6	.6	[illegible]
16	2.9	1.6	1.1	1.9	.9	1.7	.6	1.8	1.2	.5	.5	[illegible]
17	4.2	1.5	1.0	1.7	.8	1.6	.8	3.0	.9	.6	.6	[illegible]
18	3.4	1.4	1.0	1.6	.9	1.5	1.0	2.5	3.4	.5	.5	[illegible]
19	2.3	1.4	1.0	2.8	.8	1.2	1.4	2.0	4.6	.5	.6	[illegible]
20	2.0	1.3	1.1	2.9	1.2	1.1	.9	1.7	4.8	.4	.7	[illegible]
21	1.7	1.3	1.2	2.7	3.1	.9	.9	1.9	3.1	.4	.8	[illegible]
22	1.6	1.3	1.2	2.3	9.0	.8	.8	2.5	1.9	.5	.8	[illegible]
23	1.5	1.4	1.1	1.9	10.0	1.2	.8	6.1	1.2	.5	.7	[illegible]
24	1.4	1.5	1.6	1.7	8.0	1.4	.5	8.0	.9	.4	.6	[illegible]
25	1.7	1.5	1.7	1.4	5.0	1.0	.4	7.0	.8	.5	.5	[illegible]
26	1.6	1.6	4.2	1.3	2.8	.8	.4	5.6	.7	.4	.6	[illegible]
27	1.5	1.5	4.9	1.3	2.0	.7	.4	3.2	.7	.4	.7	[illegible]
28	1.6	1.4	3.6	1.2	1.6	1.0	.5	4.1	.8	.5	.6	[illegible]
29	1.6		2.8	1.2	1.4	1.3	.7	2.9	.8	.4	.5	[illegible]
30	1.5		2.1	1.1	1.3	1.5	.7	2.0	1.0	.4	.6	[illegible]
31	1.8		5.6		1.7		.6	1.3		.3		[illegible]
1902.												
1	8.0	3.2	12.0	4.6	1.0	.4	.1	.1	.4	1.4	1.2	[illegible]
2	5.0	8.5	1.0	2.9	1.0	.5	.0	.1	.3	1.2	.5	[illegible]
3	2.9	11.0	9.5	2.3	.9	.8	.0	.0	.2	.9	.4	[illegible]
4	2.0	9.5	5.4	2.0	.8	.6	.2	.2	.3	.6	.3	[illegible]
5	1.6	8.0	3.0	1.9	.8	.5	.1	.7	.7	1.1	.4	[illegible]

Daily gage height, in feet, of Flint River near Woodbury—Continued.

y.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
02.												
.....	1.4	3.6	2.5	1.8	0.7	0.4	0.1	1.5	0.4	1.6	0.5	2.3
.....	1.3	2.5	2.3	1.7	.7	.3	.1	1.1	.2	.8	.9	1.6
.....	1.2	2.0	2.1	2.8	.7	1.8	.2	.6	.1	.4	1.3	1.3
.....	1.2	1.7	1.9	2.7	1.2	.9	.1	.3	.2	.3	.9	1.2
.....	1.1	1.6	1.8	2.3	.9	.6	.2	.2	.3	.2	.6	.9
.....	1.2	1.5	1.7	1.9	.8	.5	.3	.1	.4	.4	.5	.8
.....	1.1	1.4	1.6	1.7	.7	.4	1.9	.3	.2	.6	.4	.9
.....	1.0	1.3	1.6	1.5	.6	.3	1.0	.6	.1	.5	.4	1.0
.....	.9	1.3	2.0	1.5	.8	.3	.6	.3	.1	.4	.3	.9
.....	1.0	1.6	2.3	1.6	.7	.4	.7	.2	.1	.3	.3	.8
.....	1.0	1.8	2.8	1.5	1.7	1.0	1.3	.4	.0	.3	.2	1.0
.....	1.0	1.8	10.0	1.6	2.3	.8	.7	.2	.0	.2	.4	2.0
.....	1.0	1.6	9.0	2.8	1.7	.6	.3	.1	.1	.2	.9	2.9
.....	1.0	1.5	6.7	2.4	1.4	.5	.2	.0	.1	.1	.8	3.0
.....	1.1	1.6	4.0	1.9	1.2	.4	.1	.0	.0	.1	.8	2.0
.....	1.2	1.9	2.5	1.6	.9	.3	.0	.0	.0	.2	.7	1.4
.....	1.6	1.8	2.3	1.4	.8	.3	.1	.5	.0	.2	.6	1.5
.....	1.5	1.7	2.1	1.3	.7	.3	.1	.2	.0	.1	.5	1.6
.....	1.3	1.6	2.0	1.2	.6	.2	.0	.1	.0	.1	.4	1.4
.....	1.2	2.0	2.7	1.3	.6	.2	.0	.0	1.5	.0	.4	1.3
.....	1.3	2.5	2.5	1.4	.5	.1	.0	.0	1.6	.2	2.9	1.2
.....	1.2	2.6	2.4	1.3	1.6	.1	.0	.0	1.5	1.0	2.8	1.1
.....	1.2	14.0	4.5	1.2	.5	.1	.0	.5	1.4	1.5	2.0	1.0
.....	1.3	.....	8.0	1.1	.4	.1	.1	1.3	1.3	2.0	1.5	1.1
.....	1.2	.....	8.5	1.1	.4	.0	.2	1.2	1.8	1.7	1.0	1.2
.....	1.5	.....	6.8	.....	.3	.....	.1	.4	.....	1.4	.....	1.3
03.												
.....	1.2	1.0	4.7	4.5	1.0	1.2	1.0	.6	.1	.2	.3	.3
.....	1.1	.9	3.7	3.9	.9	1.5	.9	.7	.2	.2	.4	.3
.....	1.0	.9	2.9	3.0	1.0	1.3	2.5	.8	.1	.2	.3	.3
.....	1.2	1.0	3.0	2.7	1.1	1.4	1.1	1.0	.0	.2	.4	.4
.....	1.1	1.2	4.2	2.3	1.0	2.2	.9	1.5	.2	.2	.5	.4
.....	1.0	1.2	3.6	2.0	.9	2.5	.8	2.5	.1	.1	.6	.4
.....	.9	1.5	2.9	1.7	2.0	2.9	2.0	1.4	.1	.2	.5	.6
.....	.8	13.0	2.4	1.8	1.9	2.8	1.2	1.0	.0	.5	.4	.5
.....	.7	11.5	2.2	2.2	1.8	2.4	1.3	.8	.0	8	.4	.6
.....	.6	10.0	2.4	2.1	1.5	2.2	1.0	1.3	.0	.5	.3	.9
.....	.6	9.0	3.0	2.3	1.3	1.5	.9	.9	.0	.3	.4	.8
.....	.5	9.5	3.1	2.2	1.0	1.2	.8	.5	.0	.3	.4	.7
.....	1.5	7.5	2.6	3.1	1.1	.9	1.7	.6	.0	.2	.5	.6
.....	1.2	5.7	2.0	2.9	1.3	.6	2.8	.8	.2	.2	.4	.8
.....	1.1	3.8	2.1	2.5	4.6	.3	2.4	.9	5.3	.1	.4	.7
.....	1.0	2.7	1.9	2.2	6.0	.5	2.0	1.0	5.9	.2	.5	.6
.....	.9	7.0	1.8	1.9	4.1	.6	1.6	1.2	4.2	.6	.5	.5
.....	.8	6.4	1.7	1.7	2.7	.5	1.0	2.7	2.7	1.1	.8	.5
.....	.7	5.4	1.6	1.4	1.8	.5	.6	6.0	1.6	.7	.7	.4
.....	.8	3.9	1.5	2.1	1.5	.5	1.0	3.6	1.2	.5	.6	.6
.....	.9	2.7	1.4	2.9	1.3	.4	.6	2.0	.8	.4	.5	.9
.....	.8	2.0	1.8	2.5	1.2	.5	.4	1.4	.7	.4	.6	.9
.....	.7	1.7	5.6	1.9	1.1	.5	.2	1.1	.6	.3	.5	.8
.....	.8	1.5	7.5	1.5	1.0	.5	.1	9	.5	.3	.5	.7
.....	.9	1.4	5.8	1.3	.9	.4	.2	.5	.4	.2	.4	.6
.....	.9	1.3	5.8	2.2	8	.5	.8	.4	.4	.3	.5	.5
.....	.8	1.4	3.7	2.0	.7	1.9	.6	.2	.3	.2	.4	.4
.....	1.4	3.0	2.2	1.5	.6	1.5	.4	.3	.4	.2	.4	.8
.....	1.5	.....	2.5	1.2	.8	1.6	.3	.2	.3	.3	.4	.7
.....	1.3	.....	4.5	1.1	.9	1.3	.2	.1	.3	.3	.4	.7
.....	1.1	.....	4.9	.....	.8	.....	.5	.3	.....	.2	.....	.6
04.												
.....	.5	.9	1.2	.7	.4	1.1	.3	.4	.2	− .25	− .35	.1
.....	.5	.9	1.3	.6	.4	1.0	.2	1.3	.1	− .3	− .3	.2
.....	.6	.8	1.5	.7	.5	.8	.1	1.1	.1	− .3	− .2	.3
.....	.7	.7	1.6	.6	.6	.5	.1	1.2	.5	− .3	.0	.4
.....	.6	.8	2.0	.6	.5	.3	.0	2.2	.8	− .3	.0	.5
.....	.5	.7	2.5	.7	.5	1.0	.0	2.1	.7	− .35	.1	.9
.....	.6	.8	2.3	.8	.4	.8	.0	2.2	.3	− .35	.0	.9
.....	.7	2.6	2.2	.9	.3	.6	− .05	8.7	.2	− .4	.0	.7
.....	.6	2.5	2.1	1.9	.2	.5	.1	6.5	.2	− .4	− .1	.5
.....	.8	2.3	1.9	1.4	.3	.4	.1	5.0	.1	− .4	− .05	.5

Daily gage height, in feet, of Flint River near Woodbury—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1904.												
11	1.2	2.8	1.5	1.0	0.3	0.4	0.6	5.0	0.0	0.35	0.05	0.4
12	1.0	2.5	1.3	.8	.3	.0	.3	3.5	.0	.35	.05	.3
13	.9	2.2	1.1	.7	.2	.0	.2	3.0	.0	.4	.1	.3
14	.8	2.0	1.2	.6	.1	.0	.2	1.2	— .05	.4	.2	.3
15	.7	1.7	1.4	.6	.2	— .05[a]	.0	1.5	— .1	.4	.2	.3
16	.8	1.4	1.2	.6	.2	— .05	— .05	1.4	— .1	— .4	.1	.3
17	1.3	1.2	1.0	.5	.1	— .05	— .1	.9	— .1	— .45	.1	.4
18	1.5	1.1	1.0	.5	.2	— .05	— .1	.5	— .1	— .45	.1	.3
19	1.4	1.2	.9	.4	.1	— .05	.1	.5	— .15	— .4	.1	.3
20	1.2	1.4	.9	.5	.1	— .05	.1	.4	— .2	— .4	.0	.3
21	1.0	1.5	.8	.4	.1	— .05	— .05	.3	— .15	— .45	.0	.3
22	1.1	2.6	.9	.4	.0	— .05	.2	.3	— .15	— .45	.1	.3
23	3.2	3.0	.9	.5	.0	— .05	.1	.3	— .2	— .45	.1	.3
24	3.0	2.9	.9	.4	.0	— .05	.8	.4	— .25	— .5	.2	.3
25	2.7	2.5	.8	.5	.0	— .05	1.0	.3	— .15	— .45	.2	.4
26	1.9	2.0	.9	.4	.0	.0	.4	.7	— .3	— .4	.1	.3
27	1.5	1.9	.9	.5	.0	.0	.2	.1	— .2	— .35	.1	.3
28	1.2	1.4	.8	.4	.0	.0	.1	.3	— .2	— .4	.1	.3
29	1.1	1.2	.9	.4	.0	.4	.0	.6	— .25	— .35	.1	.3
30	1.0	.....	.8	.5	.0	.4	.1	.5	— .25	— .35	.1	.3
31	.9	.....	.8	.....	1.0	.....	.2	.3	.....	— .4	.....	.3
1905.												
1	.9	.5	1.0	.6	.7	.1	1.7	.1	.0	.3	.2	.4
2	.6	.5	.9	.5	.6	.1	2.6	.0	.0	.6	.1	.3
3	.7	.4	.8	.5	.7	.2	2.6	— .1	.2	.4	.1	.3
4	.6	.4	.7	.5	1.2	.1	1.5	— .1	.6	.6	.1	.4
5	.5	.5	.6	1.0	1.4	.2	1.3	— .2	.6	.7	.1	.3
6	.5	.6	.8	1.2	1.3	.1	1.0	— .2	.3	.4	.0	.4
7	.6	1.0	.8	1.1	.9	.0	.6	— .3	.3	.2	.1	.3
8	.7	1.9	.8	1.0	.6	.0	.7	.2	.1	.0	.1	.2
9	.6	3.0	.8	.9	.8	— .1	.6	.5	.0	— .1	.1	.2
10	.5	3.2	.9	1.1	.8	— .1	.5	2.2	— .1	.0	.2	.2
11	.4	2.7	1.0	1.1	.7	.2	.9	2.3	— .2	.1	.9	.3
12	.9	3.5	1.1	1.0	.5	— .2	1.2	2.3	— .2	.3	1.1	.2
13	2.1	5.4	1.3	1.1	.4	— .1	1.2	2.1	.0	.4	1.0	.2
14	2.0	6.3	1.2	1.0	.3	.1	.7	2.0	.0	.4	.8	.1
15	1.9	4.9	1.0	.8	.3	.3	.6	1.8	— .1	.3	.6	.1
16	1.6	3.5	.9	.8	.4	.5	.5	2.6	— .2	.3	.5	.1
17	1.3	2.5	.9	.8	.5	.2	.4	3.9	— .2	.2	.4	.1
18	1.0	2.1	.8	.7	.5	.1	.2	2.6	— .3	.1	.3	.1
19	.8	1.7	.7	.6	.3	.1	.1	1.5	— .3	.1	.2	.1
20	.8	1.5	.6	.6	.2	.0	.4	.8	— .3	.1	.2	.1
21	.8	2.0	1.0	.6	.3	.0	.1	.6	— .3	.0	.2	.1
22	.7	2.0	1.1	.5	.4	.1	.3	.4	— .4	.0	.1	.1
23	.6	1.8	1.3	.5	.4	.3	.0	.3	— .4	.0	.1	.1
24	.6	1.7	1.2	.5	.8	.4	— .1	.4	— .4	.0	.2	.1
25	.5	1.5	1.0	.5	.7	.4	.3	1.2	— .5	— .1	.2	.1
26	.4	1.3	.8	.4	.5	.2	.1	1.0	— .5	.8	.2	.1
27	.4	1.1	.7	.4	.4	.2	.0	.9	— .4	.6	.2	.1
28	.3	1.0	.7	.4	.3	.1	.1	.7	— .4	.5	.2	.1
29	.3	.....	.6	.5	.3	.2	.3	.3	— .4	.3	.2	.1
30	.4	.....	.6	.6	.2	.3	.1	.1	— .2	.3	.3	.1
31	.5	.....	.5	.....	.2	.....	.1	.1	.....	.2	.....	.1

[a] June 15 to 25 observer reported "below zero," but stated afterwards that he did not think it went as much as 1 tenth below.

Rating tables for Flint River near Woodbury.

APRIL 1, 1900, TO DECEMBER 31, 1901.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	350	1.10	890	2.20	2,340	3.30	3,880
.10	370	1.20	1,000	2.30	2,480	3.40	4,020
.20	400	1.30	1,120	2.40	2,620	3.50	4,160
.30	430	1.40	1,245	2.50	2,760	3.60	4,300
.40	460	1.50	1,370	2.60	2,900	3.70	4,440
.50	495	1.60	1,500	2.70	3,040	3.80	4,580
.60	530	1.70	1,640	2.80	3,180	3.90	4,720
.70	585	1.80	1,780	2.90	3,320	4.00	4,860
.80	650	1.90	1,920	3.00	3,460	4.10	5,000
.90	720	2.00	2,060	3.10	3,600		
1.00	800	2.10	2,200	3.20	3,740		

JANUARY 1, 1902, TO DECEMBER 31, 1903.[b]

0.00	290	1.80	1,920	3.60	4,240	6.80	10,200
.10	320	1.90	2,040	3.70	4,390	7.00	10,750
.20	360	2.00	2,160	3.80	4,540	7.20	11,250
.30	410	2.10	2,280	3.90	4,690	7.40	11,750
.40	470	2.20	2,400	4.00	4,840	7.60	12,250
.50	540	2.30	2,520	4.20	5,160	7.80	12,750
.60	620	2.40	2,640	4.40	5,480	8.00	13,250
.70	705	2.50	2,760	4.60	5,820	8.20	13,750
.80	800	2.60	2,880	4.80	6,160	8.40	14,250
.90	900	2.70	3,020	5.00	6,520	8.60	14,750
1.00	1,005	2.80	3,150	5.20	6,880	8.80	15,250
1.10	1,115	2.90	3,280	5.40	7,260	9.00	15,750
1.20	1,225	3.00	3,410	5.60	7,640	10.00	18,250
1.30	1,340	3.10	3,545	5.80	8,040	11.00	21,250
1.40	1,455	3.20	3,680	6.00	8,450	12.00	23,750
1.50	1,570	3.30	3,820	6.20	8,880	13.00	26,250
1.60	1,685	3.40	3,960	6.40	9,320	14.00	28,750
1.70	1,800	3.50	4,100	6.60	9,780	15.00	31,250

JANUARY 1, 1904, TO DECEMBER 31, 1905.[c]

− 0.50	120	−.30	180	−.10	240	.10	320
− .40	150	−.20	200	.00	280		

[a] Between gage height 1.60 and 4.10 feet the rating curve is a tangent, the difference being 140 per tenth. Above gage height 4.10 the 1902 curve has been used to obtain revised estimates for 1900 and 1901.
[b] Above gage height 6.90 feet the rating curve is a tangent, the difference being 250 per tenth.
[c] Above gage height 0.10 foot this table is the same as the 1903 table.

Estimated monthly discharge of Flint River near Woodbury.

[Drainage area, 988 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1900.					
April	8,040	800	2,244	2.27	2.53
May	1,920	490	757	.77	.89
June	15,750	490	4,127	4.18	4.66
July	5,650	490	1,680	1.70	1.96
August	2,760	370	611	.62	.71
September	1,500	370	557	.56	.62
October	1,780	370	641	.65	.75
November	3,880	460	911	.92	1.03
December	5,320	490	1,923	1.95	2.25

Estimated monthly discharge of Flint River near Woodbury—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.[a]					
January	5,990	1,245	2,814	2.85	3.29
February	7,260	1,120	2,416	2.45	2.55
March	7,640	800	1,799	1.82	2.10
April	12,250	890	2,951	2.99	3.34
May	18,250	580	2,670	2.70	3.11
June	3,740	580	1,617	1.64	1.83
July	2,200	460	780	.79	.91
August	13,250	460	2,657	2.69	3.10
September	6,160	460	1,259	1.27	1.42
October	3,040	430	679	.69	.80
November	650	460	526	.53	.59
December	10,750	530	2,379	2.41	2.78
The year	10,750	430	1,879	1.90	25.82
1902.					
January	13,250	900	1,891	1.91	2.20
February	30,250	1,340	5,143	5.21	5.43
March	24,250	1,685	6,721	6.80	7.84
April	5,820	1,115	2,042	2.07	2.31
May	2,520	410	934	.95	1.10
June	1,920	290	552	.56	.62
July	2,040	290	470	.48	.55
August	1,570	290	512	.52	.60
September	1,920	290	609	.62	.69
October	2,160	290	752	.76	.88
November	3,280	360	900	.91	1.02
December	3,080	800	1,676	1.70	1.96
The year	30,250	290	1,850	1.87	25.29
1903.					
January	1,570	540	977	.99	1.14
February	25,750	900	6,508	6.59	6.87
March	12,000	1,455	3,915	3.96	4.57
April	5,650	1,115	2,460	2.49	2.78
May	8,450	620	1,755	1.78	2.05
June	3,280	410	1,315	1.33	1.48
July	3,150	320	1,107	1.12	1.29
August	8,450	320	1,363	1.38	1.59
September	8,240	290	1,203	1.22	1.36
October	1,115	329	451	.46	.53
November	800	410	985	1.00	1.12
December	960	410	629	.64	.74
The year	25,750	290	1,889	1.91	25.51
1904.					
January	3,680	540	1,207	1.22	1.41
February	3,410	705	1,838	1.86	2.01
March	2,760	800	1,326	1.34	1.55
April	2,040	470	687	.695	.78
May	1,005	280	394	.399	.46
June	1,115	290	442	.447	.50
July	1,005	240	368	.372	.43
August	15,000	320	2,198	2.22	2.56
September	800	180	302	.306	.34
October	195	120	155	.157	.18
November	360	165	295	.299	.33
December	1,570	320	586	.593	.68
The year	15,000	120	816	.826	11.23
1905.					
January	2,280	410	837	.847	.98
February	9,100	470	2,454	2.48	2.58
March	1,340	540	885	.896	1.03
April	1,225	470	751	.760	.85
May	1,455	360	627	.635	.73
June	540	210	334	.338	.37
July	2,800	240	789	.799	.92
August	4,690	180	1,164	1.18	1.36
September	620	120	251	.254	.28
October	800	240	412	.417	.48
November	1,115	280	446	.451	.50
December	7,260	410	3,016	3.05	3.52
The year	9,100	120	997	1.01	13.61

[a] Estimates above gage height 4.1 feet have been revised on the basis of the 1902 rating curve.

FLINT RIVER NEAR MONTEZUMA.

This station is located at the iron highway bridge about 1 mile west of Montezuma. Some discharge measurements had already been made at this point when the United States Weather Bureau established a standard chain gage on the bridge, late in 1904. During 1905 the daily gage heights were furnished by the Weather Bureau.

The channel is slightly curved above and below the station, which is near the point of reverse between the curves. The current is moderate. The right bank, which is mostly covered with a dense growth of brush, will overflow for a great distance at about 12 feet above low water; the left bank is not apt to overflow. The bed is sandy and probably shifting and the current is slow at low stage, especially near the left bank.

Discharge measurements are made from the bridge of two 100-foot spans, with a short trestle approach on the left bank and a very long one across the marshy ground on the right bank. The initial point for soundings is the end of the left-bank approach, downstream side.

The gage is located on the upstream side of the right span of the bridge near the middle pier. The bench mark is the top of the upstream tubular pier at the middle of the bridge; elevation, 28.00 feet above the datum of the gage.

Discharge measurements of Flint River near Montezuma.

Date	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec.-ft.*
July 18	4.38	2,398	August 23	3.15	1,608
1904.			August 31	2.41	1,249
September 21	1.85	971	October 12	2.25	1,148

Daily gage height, in feet, of Flint River near Montezuma.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	5.1	3.2	6.0	4.3	3.6	4.0	3.3	1.8	2.3	1.8	2.1	2.4
2	4.4	3.2	5.8	4.0	3.6	3.5	5.1	1.9	3.3	4.1	2.1	2.4
3	4.1	3.2	5.6	4.0	4.5	3.0	6.5	1.9	4.6	4.0	2.0	2.8
4	4.7	3.2	5.5	4.0	5.3	3.0	7.5	1.8	4.2	3.2	2.0	3.6
5	3.4	3.2	5.1	4.0	6.0	3.0	7.5	1.7	4.0	3.3	2.0	7.8
6	3.4	3.5	5.0	4.3	5.7	3.2	5.8	1.6	3.8	3.0	2.0	8.2
7	3.5	3.7	5.0	4.8	5.6	2.9	5.0	1.5	3.4	3.4	2.0	9.0
8	3.6	5.4	4.8	5.2	6.3	2.7	3.9	1.4	3.2	2.9	2.0	9.7
9	3.6	7.4	4.7	5.0	6.2	2.4	3.2	1.3	2.5	2.4	1.9	9.9
10	3.6	9.2	4.7	4.9	5.7	2.2	2.5	2.3	2.0	2.2	2.0	9.8
11	3.5	10.5	6.0	4.7	4.8	2.2	2.5	5.2	1.8	2.0	2.6	9.7
12	3.4	12.0	6.4	4.5	4.3	2.0	3.0	6.6	1.7	2.2	4.1	9.5
13	4.0	14.0	6.7	5.6	3.9	2.0	4.0	7.0	1.6	2.4	4.7	9.4
14	4.6	15.0	8.2	7.6	3.5	2.1	4.4	7.6	2.7	2.4	4.6	9.2
15	7.6	17.3	8.6	8.5	3.2	2.3	4.0	8.2	2.9	2.2	4.6	7.6
16	7.2	17.1	6.7	7.1	3.2	2.4	3.7	7.7	2.3	2.1	4.0	6.2
17	6.4	15.5	6.0	5.7	5.1	2.5	3.0	7.4	1.9	2.1	3.2	5.6
18	5.7	13.9	5.5	5.0	6.6	3.1	2.8	7.1	1.6	2.2	2.9	5.5
19	5.0	12.5	5.2	4.7	5.6	3.2	2.5	7.7	1.5	2.1	2.5	5.4
20	5.0	10.0	5.0	4.3	4.8	2.5	2.3	7.4	1.5	2.0	2.5	5.6
21	5.0	9.0	5.8	4.2	3.6	2.3	2.1	5.0	1.4	2.0	2.5	8.0
22	4.3	8.5	6.4	4.1	3.5	2.2	2.0	3.7	1.4	1.9	3.6	10.0
23	4.0	9.0	8.0	4.1	3.3	2.3	2.0	3.1	1.3	1.9	3.7	11.7
24	4.0	9.3	7.2	4.3	4.6	2.5	2.0	3.0	1.3	1.8	3.8	12.7
25	3.9	9.5	6.6	4.0	6.0	3.4	2.0	3.0	1.2	1.8	3.0	13.9
26	3.7	8.0	6.0	3.7	6.2	2.9	2.1	3.7	1.1	1.8	2.4	13.0
27	3.6	7.2	5.7	3.8	5.2	2.4	2.3	4.3	1.0	2.4	2.5	11.8
28	3.3	6.5	5.2	3.9	5.0	2.4	2.2	3.5	1.2	3.7	2.4	9.4
29	3.2	.....	4.9	3.8	4.2	2.5	2.0	3.2	1.2	3.4	2.4	7.9
30	3.2	.....	4.7	3.7	3.6	2.9	1.9	2.8	1.4	3.0	2.4	6.5
31	3.2	.....	4.5	.....	3.7	.....	1.8	2.5	.....	2.2	.....	6.3

FLINT RIVER AT ALBANY.

This station was originally established by the United States Weather Bureau April 10, 1893, and has been maintained from that date to the present. Discharge measurements by the Geological Survey were begun at this station in 1901, and the gage-height records furnished by the Weather Bureau have been used, except for a portion of the year 1903. The present observer, D. W. Brosnan, is paid by the Weather Bureau.

The channel above the station is straight for about 1,000 feet and is rough. Below the station the channel is straight for 700 feet. The river overflows both banks, but only under the approaches to the bridge. The bed is constant, but rough, and the current is irregular.

Discharge measurements are made from the Atlantic Coast Line two-span railroad bridge, which is 325 feet long, with 475 feet of trestle approach on the right bank and 240 feet on the left bank. The initial point for soundings is the center of the tubular iron pier on the upstream side of the bridge on the left bank.

The gage was washed out and replaced in 1898. It was again injured in 1902, and was replaced by a new gage June 17, 1902. The new gage was set 0.75 foot lower than the old gage as it existed prior to June 17,

1902. The gage heights were corrected from January 1 to June 17, 1902, inclusive, to correspond with the new gage. The Weather Bureau gage is attached to the Dougherty County Bridge, located about 700 feet below the Atlantic Coast Line bridge. It is in three sections. No. 1 is attached to the crib around the middle piers and extends to 4 feet above zero; No. 2 is spiked to a green cypress tree just above the bridge on the west bank of the river, and reads from 2 to 17 feet; No. 3 is spiked to a cedar post 16 feet high. This section begins at 17 feet and reads to 32 feet, which is 2½ feet above any high water known since 1840.

A standard chain gage belonging to the United States Geological Survey was installed April 20, 1904. It is fastened to the hand railing of the downstream footway of the Dougherty County Bridge near the middle of the west span. The gage was accurately set to correspond with the bench marks previously established, and its readings agree with the standard portion of the Weather Bureau gage. The bottom of the box is 45.34 feet above the zero of the gage, and the length of the chain is 47.34 feet.

Bench marks were established as follows: (1) A copper plug set in the downstream corner of the brick abutment on the right bank under the Dougherty County Bridge; elevation 33.81 feet. (2) The top of the first crossbeam from the right bank, upstream end of the railroad bridge; elevation, 43.20 feet.

Discharge measurements of Flint River at Albany.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
March 9	4.75	5,364	April 19	2.78	4,474
March 26	8.05	10,680	June 18	.25	2,111
April 18	8.70	10,720	September 22	.20	2,044
July 19	2.63	4,256	September 23	.20	2,104
			November 15	1.11	3,030
1902.			November 16	1.20	3,056
June 25	1.90	3,386	November 21	.63	2,423
June 25	1.90	3,440	November 21	.61	2,378
September 26	1.20	2,492			
December 4	6.11	8,006	1905.		
			April 26	4.38	6,398
1903.			August 25	1.42	3,073
March 6	13.68	18,630	August 28	1.82	3,634
May 21	16.80	23,120	October 14	.79	2,640
July 3	5.65	7,744			
September 18	13.06	16,640			
October 14	1.90	3,484			
December 22	3.25	5,035			

Daily gage height, in feet, of Flint River at Albany.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	6.8	3.8	9.6	8.9	4.8	4.3	2.6	3.0	2.3	2.2	1.8	2.2
2	6.1	5.0	11.8	9.3	4.8	3.6	2.3	3.0	2.0	2.0	1.7	3.6
3	6.7	6.8	15.0	9.8	4.9	2.8	2.0	2.8	1.8	1.8	1.6	4.2
4	6.9	9.0	19.6	9.8	5.1	2.6	2.0	2.4	1.6	1.7	1.7	6.1
5	6.8	11.9	20.9	10.5	5.0	2.5	2.2	2.4	1.6	1.7	1.5	7.3
6	6.6	12.6	22.7	10.8	5.1	2.5	2.1	2.5	1.4	1.8	1.1	7.6
7	7.5	13.3	22.9	9.9	4.8	2.6	1.8	2.8	1.6	1.7	.6	8.2
8	8.3	14.5	19.7	8.8	4.6	2.9	1.7	3.1	1.4	1.3	.4	8.9
9	9.1	14.8	17.6	8.7	3.9	4.1	1.7	3.1	1.8	1.4	.2	9.4
10	9.9	15.9	15.1	7.9	3.7	4.1	1.6	2.9	2.5	1.2	.1	9.9
11	10.8	16.1	11.2	7.8	3.8	4.3	1.4	2.7	3.2	1.0	.4	10.1
12	12.1	14.0	10.4	7.5	3.6	4.5	1.1	2.7	3.2	.9	.6	9.7
13	13.3	11.9	9.8	7.2	3.5	4.5	1.3	2.5	3.4	.8	.9	9.2
14	13.8	10.4	9.5	7.2	3.1	4.9	1.5	2.9	3.4	.7	.9	7.6
15	14.5	7.8	8.9	7.0	2.6	4.8	2.2	3.8	3.6	.7	1.1	6.4
16	14.3	6.9	11.5	7.5	2.5	4.5	2.1	3.6	3.9	.7	.8	6.0
17	12.1	6.6	16.3	7.6	2.6	4.9	2.0	3.4	4.3	.6	.6	5.6
18	10.8	6.0	17.0	7.5	3.0	4.3	1.9	3.4	4.4	.7	.4	5.1
19	10.1	7.6	15.6	7.6	3.3	3.9	1.8	3.2	3.9	.5	.4	4.7
20	9.8	7.8	14.1	7.8	3.6	3.7	1.8	3.1	3.7	.4	.3	4.4
21	8.6	8.9	12.8	7.9	3.1	3.1	1.8	2.9	3.9	.9	.1	4.0
22	7.1	9.8	11.7	8.0	2.8	2.8	1.9	2.2	4.1	1.2	.2	3.5
23	6.5	10.3	11.4	8.1	2.5	2.6	2.2	2.1	4.0	1.3	.4	3.7
24	5.1	9.7	10.8	7.9	2.6	2.6	2.6	1.9	4.0	1.8	.4	3.8
25	4.6	8.8	10.7	7.8	3.1	1.9	2.9	1.9	3.2	1.9	.5	4.1
26	4.4	8.1	10.5	7.6	3.5	2.3	2.9	1.8	1.2	2.1	.6	4.3
27	4.3	7.8	9.9	6.8	3.6	2.2	3.2	2.0	2.6	2.0	.9	4.9
28	4.3	7.9	9.6	6.5	3.8	2.2	3.4	2.2	2.4	1.8	.9	5.1
29	4.3	.....	9.6	5.6	4.3	2.0	3.4	2.4	2.2	1.7	1.3	5.0
30	4.2	.....	8.7	4.8	4.6	2.0	3.4	2.4	2.0	1.6	1.8	5.2
31	3.9	.....	7.9	.....	4.6	.....	3.2	2.3	.....	1.9	.....	4.9
1903.												
1	4.1	4.5	8.1	14.4	5.9	4.8	6.5	2.4	2.5	2.6	1.7	3.1
2	3.5	4.9	7.0	13.7	4.6	4.4	6.4	2.3	2.4	2.5	1.7	2.9
3	3.0	5.3	7.9	13.0	4.7	4.5	5.8	2.2	2.4	2.4	1.9	2.8
4	3.2	5.6	8.5	13.0	4.0	5.6	4.7	2.1	2.3	2.3	2.9	2.8
5	3.4	5.4	9.6	13.0	3.9	7.3	4.0	2.5	2.2	2.2	5.0	2.7
6	3.9	5.1	13.5	12.6	3.7	9.0	4.6	3.4	2.0	2.1	7.5	2.7
7	4.2	5.1	14.5	11.5	4.5	11.4	4.5	5.4	1.9	2.0	7.8	2.6
8	4.2	5.0	13.9	10.0	5.2	13.2	4.3	6.5	1.8	2.0	6.7	2.6
9	4.2	5.0	13.5	9.0	5.9	13.7	4.7	6.9	1.7	1.9	5.5	2.9
10	4.6	5.4	11.7	8.5	6.9	13.1	6.0	7.0	1.5	1.9	4.6	3.3
11	4.7	7.2	11.6	9.0	7.7	12.4	6.6	5.5	1.4	2.0	3.9	3.5
12	5.2	8.9	10.7	9.6	8.0	11.5	7.2	4.6	1.2	2.1	3.7	3.7
13	5.2	15.8	9.3	10.1	9.0	9.4	8.2	4.3	1.1	2.1	3.8	3.8
14	5.4	21.6	8.7	10.9	9.2	7.0	8.3	4.0	1.5	1.9	4.0	3.8
15	5.4	22.8	8.5	11.0	9.8	5.5	7.4	4.1	6.6	1.7	3.9	3.6
16	5.4	24.6	8.5	11.5	11.9	4.4	6.4	4.4	11.8	1.6	3.8	3.5
17	5.2	25.0	8.5	12.0	16.3	3.8	6.3	5.2	12.8	1.9	3.7	3.4
18	4.7	24.1	8.0	12.3	16.7	3.4	6.2	6.8	13.0	2.5	3.6	3.3
19	4.7	22.6	7.5	12.5	15.7	3.2	5.5	8.0	13.4	3.2	3.6	3.1
20	4.4	21.8	7.0	12.0	16.0	3.1	4.1	9.1	15.0	3.9	3.6	3.1
21	4.4	19.7	6.5	10.0	16.7	3.1	3.6	10.0	16.8	4.2	3.5	3.1
22	4.6	16.2	6.5	8.0	16.6	3.0	3.0	10.7	17.0	3.6	3.5	3.2
23	4.6	14.1	6.3	7.6	14.5	3.0	2.5	10.8	15.4	3.0	3.4	3.5
24	4.1	13.9	6.5	7.6	10.0	3.5	2.3	10.7	10.7	2.5	3.3	3.7
25	3.7	12.6	7.0	7.7	6.3	4.1	2.6	10.7	4.8	2.3	3.3	3.7
26	3.5	11.2	7.1	7.3	5.5	3.7	3.0	10.6	4.0	2.1	3.2	3.8
27	3.3	10.6	9.0	6.2	4.9	3.5	3.4	10.6	3.7	2.0	3.3	4.2
28	3.4	9.1	10.0	5.4	4.2	3.6	3.9	7.3	3.4	1.9	3.3	4.1
29	3.6	.....	11.8	5.3	4.4	4.7	3.6	3.3	3.2	1.8	3.3	3.8
30	4.1	.....	14.4	5.2	4.5	6.0	2.8	2.9	2.8	1.8	3.2	3.6
31	4.3	.....	14.8	.....	5.0	.....	2.6	2.6	.....	1.7	.....	4.1

Daily gage height, in feet, of Flint River at Albany—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
	5.2	6.3	8.2	4.2	2.0	0.9	0.5	1.1	5.3	—0.1	—0.3	0.5
	4.4	5.9	7.3	3.9	2.0	1.5	1.5	1.6	3.1	— .1	— .3	.6
	4.2	5.6	6.7	3.7	1.9	2.6	1.5	1.6	2.2	— .1	— .2	.7
	4.2	5.2	6.4	3.6	1.9	2.7	1.1	2.9	1.8	— .2	.1	1.6
	4.1	5.0	6.3	3.4	2.4	2.4	.8	5.5	1.6	— .3	.5	2.8
	4.0	4.7	6.6	3.2	2.5	1.9	.6	5.9	1.5	— .3	.8	3.6
	3.9	4.8	7.0	3.3	2.2	1.5	.5	5.6	1.7	— .3	.9	3.6
	4.4	5.2	7.3	4.1	1.9	1.3	.5	6.4	2.3	— .3	.8	3.5
	4.7	6.4	7.3	5.0	1.7	1.1	.4	7.2	2.3	— .2	.6	3.4
	5.1	8.8	7.8	5.4	1.6	1.3	.4	7.8	1.9	— .2	.4	3.1
	6.0	12.9	8.1	5.9	1.6	1.2	.4	8.3	1.5	— .2	.3	2.6
	6.4	16.9	8.1	5.9	1.6	1.0	.7	9.4	1.1	— .3	.3	2.4
	7.0	19.2	7.5	5.4	1.5	.8	.9	10.8	1.0	— .3	.4	2.0
	7.0	18.7	6.8	4.7	1.3	.7	1.1	12.2	.7	— .3	.7	1.8
	6.8	17.2	6.4	3.8	1.3	.6	1.4	13.1	.6	— .3	1.1	1.6
	6.4	15.8	6.2	3.4	1.3	.5	1.0	13.2	.6	— .3	1.2	1.5
	6.0	14.8	6.2	3.2	1.4	.4	.7	12.1	.5	— .3	1.1	1.4
	5.9	13.3	6.1	3.0	1.5	.3	.5	8.0	.4	— .4	.9	1.4
	5.8	10.5	5.8	2.7	1.9	.2	.4	4.9	.4	— .4	.8	1.5
	6.0	8.5	5.2	2.5	1.9	.2	.2	4.7	.3	— .4	.7	1.6
	6.0	8.4	5.0	2.4	1.7	.2	.2	2.9	.2	— .4	.7	1.6
	5.8	9.3	4.8	2.4	1.4	.1	.2	2.5	.2	— .4	.6	1.4
	6.8	10.5	4.5	2.4	1.1	.3	.4	2.1	.2	— .4	.7	1.3
	8.1	10.9	4.2	2.3	1.0	.5	.9	2.0	.2	— .4	.9	1.2
	9.5	10.9	4.2	2.3	.8	.5	1.4	2.0	.1	— .4	1.1	1.2
	9.7	10.6	4.1	2.2	.8	.4	1.2	2.2	.1	— .5	1.1	1.2
	10.0	10.4	4.5	2.2	.7	.4	1.0	2.8	.1	— .5	1.0	1.2
	10.4	10.1	5.0	2.1	.6	.3	1.2	4.0	.0	— .5	.9	1.6
	10.3	9.4	4.9	2.0	.5	.3	1.0	4.1	.0	— .4	.7	2.3
	9.0	.....	4.8	2.0	.6	.3	.7	6.0	.0	— .4	.6	3.2
	7.0	.....	4.3	.....	.9	.....	1.0	6.4	.....	— .3	.....	4.1
1905.												
	4.2	2.2	8.0	5.0	4.6	2.8	1.9	.5	.8	.0	1.2	.8
	3.8	2.4	7.2	4.7	4.2	3.1	2.4	.4	.8	1.0	.8	.7
	3.1	2.3	6.7	4.5	4.9	3.2	3.0	.4	1.1	1.8	.7	1.1
	2.6	2.3	6.3	4.2	5.9	2.7	4.0	.4	1.6	2.5	.6	1.3
	2.2	2.2	5.9	4.1	6.4	2.2	4.4	.5	2.5	2.2	.6	2.2
	2.0	2.2	5.7	4.1	6.7	2.0	4.4	.4	2.0	2.0	.4	3.6
	2.3	2.6	5.5	4.0	6.6	2.0	4.0	.2	1.6	1.8	.6	4.5
	2.7	3.2	5.2	4.2	6.1	2.0	2.9	.1	1.5	1.6	.5	5.1
	2.7	5.2	5.1	5.0	5.5	1.7	2.2	.2	1.1	1.6	.3	6.0
	2.5	6.7	5.8	5.4	5.4	1.4	1.6	.5	.7	1.3	.4	6.6
	2.3	8.3	6.0	5.6	4.8	1.2	1.5	1.2	.5	1.7	.8	7.0
	2.1	10.9	7.8	6.0	4.0	1.1	1.6	3.1	.3	.9	1.2	6.9
	2.6	15.5	9.6	7.9	3.6	1.0	1.7	4.2	.5	.8	1.9	6.5
	3.4	18.4	10.7	9.4	3.1	1.0	1.5	5.9	.3	.8	3.1	6.0
	4.6	21.4	10.3	10.6	2.7	1.4	1.3	5.6	.2	.3	2.4	6.4
	6.0	25.2	10.1	9.8	2.5	1.6	1.8	5.8	.1	.8	2.7	6.3
	6.4	25.3	9.3	9.1	2.7	1.6	2.0	5.8	.4	.9	1.7	5.7
	6.1	24.5	8.1	7.6	3.7	1.9	1.8	5.2	.4	.9	1.6	5.55
	5.6	23.8	7.0	6.3	4.8	2.0	1.4	4.6	.2	.5	1.2	5.3
	4.8	22.7	6.3	5.4	5.0	2.4	1.2	4.5	.1	.7	1.2	6.3
	4.0	21.2	8.0	4.8	4.3	1.8	1.0	4.6	.0	.5	1.0	6.0
	3.6	19.1	9.3	4.7	3.5	2.0	.9	3.8	.0	.4	.8	6.8
	3.4	17.0	10.1	4.9	2.8	1.6	.7	2.4	— .1	.4	.6	9.2
	3.3	14.0	9.7	4.9	4.3	1.9	.7	1.7	— .1	.3	.6	10.9
	3.3	12.0	9.5	4.7	4.5	2.4	.8	1.4	— .2	.0	.8	11.8
	3.1	11.1	9.1	4.4	5.1	2.5	.8	1.3	— .2	.5	.7	12.6
	2.9	10.1	8.2	4.4	5.8	2.2	.7	1.6	— .3	.4	.8	13.4
	2.8	9.0	7.2	4.4	5.4	1.5	.5	1.7	— .4	.6	1.0	13.6
	2.5	.....	6.4	4.6	4.4	1.4	.8	1.7	— .2	1.3	1.0	13.3
	2.3	.....	5.8	4.7	3.7	1.8	.8	1.3	— .3	1.3	.9	11.9
	2.2	.....	5.4	.....	3.0	.....	.7	1.1	.....	1.4	.....	9.8

Rating tables for Flint River at Albany.

JANUARY 1 TO DECEMBER 31, 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.10	1,380	2.30	3,855	5.00	6,895	9.40	11,845
.20	1,495	2.40	3,970	5.20	7,120	9.60	12,070
.30	1,605	2.50	4,080	5.40	7,345	9.80	12,295
.40	1,720	2.60	4,195	5.60	7,590	10.00	12,520
.50	1,830	2.70	4,305	5.80	7,795	10.50	13,083
.60	1,945	2.80	4,420	6.00	8,020	11.00	13,645
.70	2,055	2.90	4,530	6.20	8,245	11.50	14,208
.80	2,170	3.00	4,645	6.40	8,470	12.00	14,770
.90	2,280	3.10	4,758	6.60	8,695	13.00	15,895
1.00	2,395	3.20	4,870	6.80	8,920	14.00	17,020
1.10	2,505	3.30	4,983	7.00	9,145	15.00	18,145
1.20	2,620	3.40	5,095	7.20	9,370	16.00	19,270
1.30	2,730	3.50	5,208	7.40	9,595	17.00	20,395
1.40	2,845	3.60	5,320	7.60	9,820	18.00	21,520
1.50	2,955	3.70	5,433	7.80	10,045	19.00	22,645
1.60	3,070	3.80	5,545	8.00	10,270	20.00	23,770
1.70	3,180	3.90	5,658	8.20	10,495	21.00	24,895
1.80	3,295	4.00	5,770	8.40	10,720	22.00	26,020
1.90	3,405	4.20	5,995	8.60	10,945	23.00	27,145
2.00	3,520	4.40	6,220	8.80	11,170		
2.10	3,630	4.60	6,445	9.00	11,395		
2.20	3,745	4.80	6,670	9.20	11,620		

JANUARY 1 TO DECEMBER 31, 1903.[b]

1.10	2,610	2.60	4,300	4.50	6,595	12.00	15,970
1.20	2,720	2.70	4,415	5.00	7,220	12.50	16,650
1.30	2,830	2.80	4,530	5.50	7,845	13.00	17,350
1.40	2,940	2.90	4,645	6.00	8,470	14.00	18,850
1.50	3,050	3.00	4,760	6.50	9,095	15.00	20,400
1.60	3,160	3.10	4,875	7.00	9,720	16.00	21,950
1.70	3,270	3.20	4,995	7.50	10,345	17.00	23,500
1.80	3,380	3.30	5,115	8.00	10,970	18.00	25,050
1.90	3,495	3.40	5,235	8.50	11,595	19.00	26,600
2.00	3,610	3.50	5,355	9.00	12,220	20.00	28,150
2.10	3,725	3.60	5,475	9.50	12,845	21.00	29,700
2.20	3,840	3.70	5,595	10.00	13,470	22.00	31,250
2.30	3,955	3.80	5,720	10.50	14,095	23.00	32,800
2.40	4,070	3.90	5,845	11.00	14,720	24.00	34,350
2.50	4,185	4.00	5,970	11.50	15,345	25.00	35,900

JANUARY 1, 1904, TO DECEMBER 31, 1905.

−0.50	1,480	1.50	3,235	3.50	5,225	7.00	9,150
− .40	1,560	1.60	3,330	3.60	5,330	7.20	9,380
− .30	1,645	1.70	3,425	3.70	5,435	7.40	9,610
− .20	1,730	1.80	3,520	3.80	5,540	7.60	9,840
− .10	1,815	1.90	3,615	3.90	5,645	7.80	10,070
.00	1,900	2.00	3,710	4.00	5,750	8.00	10,300
.10	1,985	2.10	3,805	4.20	5,970	8.50	10,900
.20	2,070	2.20	3,900	4.40	6,190	9.00	11,500
.30	2,155	2.30	4,000	4.60	6,410	9.50	12,100
.40	2,240	2.40	4,100	4.80	6,630	10.00	12,700
.50	2,330	2.50	4,200	5.00	6,850	11.00	14,000
.60	2,420	2.60	4,300	5.20	7,080	12.00	15,350
.70	2,510	2.70	4,400	5.40	7,310	13.00	16,750
.80	2,600	2.80	4,500	5.60	7,540	14.00	18,300
.90	2,690	2.90	4,600	5.80	7,770	15.00	20,000
1.00	2,780	3.00	4,700	6.00	8,000	16.00	21,700
1.10	2,870	3.10	4,805	6.20	8,230	17.00	23,400
1.20	2,960	3.20	4,910	6.40	8,460	18.00	25,200
1.30	3,050	3.30	5,015	6.60	8,690	19.00	27,000
1.40	3,140	3.40	5,120	6.80	8,920	20.00	28,900

[a] This rating table is based on a tangent throughout, the difference being 112.5 per tenth.
[b] Above gage height 13.50 feet the curve becomes a tangent, with a difference of 155 per tenth.

Estimated monthly discharge of Flint River at Albany.

[Drainage area, 5,000 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1902.					
ry	17,583	5,658	10,472	2.09	2.41
ary	19,383	5,545	12,279	2.46	2.56
	27,033	10,158	16,251	3.25	3.75
	13,420	6,670	10,274	2.05	2.29
	7,008	4,080	5,509	1.10	1.27
	6,783	3,405	5,020	1.00	1.12
	5,095	2,505	3,737	.75	.86
t	5,545	3,295	4,296	.86	.99
ıber	6,220	2,620	4,442	.89	.99
ır	3,745	1,720	2,793	.56	.65
ıber	3,295	1,380	2,176	.44	.49
ber	12,970	3,745	8,565	1.71	1.97
The year	27,033	1,380	7,151	1.43	19.35
1903.					
ry	7,720	4,760	6,305	1.26	1.45
ary	35,900	6,595	17,694	3.54	3.69
	20,090	8,845	13,001	2.60	3.00
	19,470	7,470	13,510	2.70	3.01
	23,035	5,595	11,769	2.35	2.71
	18,385	4,760	8,869	1.77	1.97
	11,345	3,955	7,076	1.42	1.64
t	14,470	3,725	8,529	1.71	1.97
ıber	23,500	2,610	8,709	1.74	1.94
ır	6,220	3,160	3,976	.80	.92
ıber	10,720	3,270	5,837	1.17	1.31
ber	10,095	4,300	5,789	1.16	1.34
The year	35,900	2,610	9,255	1.85	24.95
1904.					
ry	13,220	5,645	8,553	1.71	1.97
ary	27,380	6,520	13,550	2.71	2.92
	10,540	5,860	8,068	1.61	1.86
	7,885	3,710	5,175	1.04	1.16
	4,200	2,330	3,215	.643	.741
	4,400	1,985	2,683	.537	.599
	3,235	2,070	2,587	.517	.596
t	17,060	2,870	7,949	1.59	1.83
ıber	7,195	1,900	2,872	.574	.640
ır	1,815	1,480	1,629	.326	.376
ıber	2,960	1,645	2,457	.491	.548
ber	5,860	2,330	3,723	.745	.859
The year	27,380	1,480	5,205	1.04	14.10
1905.					
ry	8,460	3,710	5,156	1.03	1.19
ary	38,970	3,900	17,540	3.51	3.66
	13,610	6,965	9,862	1.97	2.27
	13,480	5,750	7,622	1.52	1.70
	8,805	4,200	6,348	1.27	1.46
	4,910	2,780	3,636	.727	.811
	6,190	2,330	3,532	.706	.814
t	7,885	1,985	4,140	.828	.955
ıber	4,200	1,560	2,343	.469	.523
ır	4,200	1,900	2,794	.559	.644
ıber	4,805	2,155	2,854	.571	.637
ber	17,680	2,510	9,232	1.85	2.13
The year	38,970	1,560	6,255	1.25	16.79

BIG POTATO CREEK NEAR THOMASTON.

ıis station was established in 1904. It is located at the highway ge about 5 miles southwest of Thomaston, 200 yards above iel's old gristmill.

ıe channel is curved for about 200 feet above and straight for 300 below the station. The current is fairly swift, except at very low es. Both banks are subject to occasional overflow. The bed of

the stream is composed of rock and gravel, free from vegetation, a probably constant. There is but one channel at all stages, brok during the higher water by the piers of the bridge. Discharge measu ments are made from the downstream side of the single-span ir bridge, which has trestle approaches of about 100 feet at each e The initial point for soundings is the left end of the bridge on t downstream side.

Gage heights are determined directly from the bench marks, whi are as follows: (1) The top of the downstream end of the first fl beam from the left bank; elevation, 23.00 feet. (2) A chisel mark the intermediate post at the downstream end of the second floor bea elevation, 28.00 feet. Elevations refer to the datum of the assum gage.

Discharge measurements of Big Potato Creek near Thomaston.[a]

Date.	Gage height.	Discharge.	Date.	Gage height.	Di cha
1904.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.*
March 31	2.32	164	October 5	1.70	
May 24	1.75	60			
July 6	1.80	61	1905.		
September 23	1.74	49	September 21[b]	1.60	
September 23	1.72	47	September 21[c]	1.53	
October 5	1.69	43			

[a] There is a mill some distance above this point, which affects the flow more than was at t thought, making the discharge measurements of little or no value.
[b] 700 feet below bridge.
[c] Measured at Daniel's mill bridge.

MUCKALEE CREEK NEAR LEESBURG.

This station was established in 1905 in connection with the regul station on Kinchafoonee Creek. It is located about 3 miles east Leesburg, at a wooden highway bridge consisting of two truss span with trestle approaches of about 50 feet on each side.

The current is slow at low water. The right bank will overflow a moderately high water for a long distance. Gage heights are deter mined directly from the bench mark, which is the top of the upstrea end of the wooden cap of the middle bent of the bridge; elevation 17.00 feet above the datum of the assumed gage.

Discharge measurements of Muckalee Creek near Leesburg.

Date.	Gage height.	Di charg
1905.	*Feet.*	*Sec.-f*
August 30	2.02	1
October 13	2.75	2

MUCKALEE CREEK NEAR ALBANY.

This station was established March 9, 1903, as a temporary station by F. A. Murray, and was discontinued December 31, 1903. It wa located at a wagon bridge 3 miles north of Albany, and a shor distance below the mouth of Kinchafoonee Creek.

he channel was straight for 300 feet above the station and for 200 below, and the current was regular and of moderate velocity. a banks were high and did not overflow. The bed was rocky and ably permanent, the river flowing in one channel at all stages. kwater from the Flint River affected the discharge at high stages. harge measurements were made from the single-span highway ge and its approaches. During 1905 the station was deeply cov- with water by a large water-power development just below.

Discharge measurements of Muckalee Creek near Albany.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1903.	*Feet.*	*Sec.-ft.*
9	2.30	1,777	May 22	7.40	2,829
26	4.60	3,244	July 2	1.88	1,473
18	3.02	2,600	September 19	6.22	4,195
9	1.36	1,001	October 15	.72	644
			December 22	1.59	1,343
1902.					
5	.97	746	1904.		
nber 27	.90	690	April 22	1.45	1,051
ber 4	2.50	2,180	June 18	.33	419
			September 22	.35	455
1903.			November 16	.95	832
6	6.60	5,141			

age heights for 1901 and 1902 were obtained by measuring down a bench mark to water.

Daily gage height, in feet, of Muckalee Creek near Albany.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.										
		4.8	1.6	1.9	1.9	1.2	1.1	1.3	1.0	1.6
		5.0	1.6	1.8	2.0	1.3	1.1	1.3	1.1	1.6
		4.9	1.6	1.7	1.9	1.3	1.0	1.2	1.5	1.6
		4.9	1.6	1.9	1.9	1.2	1.0	1.2	2.0	1.6
		4.9	2.0	2.6	1.7	1.2	1.0	1.2	2.5	1.6
		4.8	2.7	3.1	1.7	1.3	.9	1.2	2.8	1.6
		4.4	2.7	3.3	1.6	1.5	.9	1.1	2.8	1.6
		3.9	2.8	2.9	1.7	1.6	.9	1.1	2.7	1.6
	4.8	3.0	3.0	2.5	1.9	1.6	.9	1.1	2.5	1.6
	4.6	2.8	3.2	2.1	2.2	1.6	.8	1.1	2.3	1.6
	4.4	2.7	3.2	2.0	2.6	1.6	.8	1.0	2.2	1.6
	4.2	2.7	3.5	1.9	2.6	1.6	.8	1.0	2.1	1.6
	3.0	3.0	3.9	1.8	2.6	1.6	.8	1.0	2.1	1.6
	2.8	3.5	4.6	1.8	2.7	1.7	1.6	1.0	2.1	1.6
	2.8	4.0	5.6	1.7	2.7	1.8	4.1	1.0	2.0	1.6
	2.8	5.3	8.8	1.5	2.5	1.9	6.5	1.0	2.0	1.6
	2.8	5.4	12.6	1.5	2.1	2.1	8.6	1.0	2.0	1.6
	2.8	5.0	11.9	1.5	1.7	2.7	8.0	1.0	2.0	1.6
	2.8	4.6	7.9	1.4	1.6	3.1	7.1	1.5	2.0	1.6
	2.8	3.0	7.8	1.4	1.5	3.5	6.0	1.5	2.0	1.6
	2.9	2.8	7.6	1.4	1.3	3.7	6.0	1.3	2.0	1.6
	2.9	2.6	7.6	1.4	1.2	4.0	6.0	1.3	2.0	1.6
	2.9	2.5	6.0	1.3	1.2	3.0	5.2	1.2	1.9	1.6
	2.9	2.4	4.5	1.5	1.2	2.3	2.6	1.1	1.9	1.6
	2.9	2.4	3.7	1.6	1.3	2.0	1.5	1.1	1.8	1.6
	3.0	2.3	2.6	1.5	1.3	1.8	1.5	1.0	1.8	1.6
	3.0	2.1	2.1	1.6	1.4	1.6	1.5	1.0	1.7	1.9
	3.0	1.8	2.0	1.6	1.5	1.4	1.5	1.0	1.6	2.4
	3.2	1.7	2.0	1.6	1.3	1.2	1.4	1.0	1.6	2.6
	4.4	1.7	1.9	1.8	1.3	1.2	1.4	1.0	1.6	2.6
	4.6	.....	1.9	.....	1.3	1.2	.....	1.0	.....	2.6

Rating table for Muckalee Creek near Albany, from March 9 to December 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	675	1.90	1,390	3.00	2,160	4.10	2,930
.90	720	2.00	1,460	3.10	2,230	4.20	3,000
1.00	770	2.10	1,530	3.20	2,300	4.30	3,070
1.10	830	2.20	1,600	3.30	2,370	4.40	3,140
1.20	900	2.30	1,670	3.40	2,440	1.50	3,210
1.30	970	2.40	1,740	3.50	2,510	4.60	3,280
1.40	1,040	2.50	1,810	3.60	2,580	4.70	3,350
1.50	1,110	2.60	1,880	3.70	2,650	4.80	3,420
1.60	1,180	2.70	1,950	3.80	2,720	4.90	3,490
1.70	1,250	2.80	2,020	3.90	2,790	5.00	3,560
1.80	1,320	2.90	2,090	4.00	2,860		

[a] Backwater from Flint River greatly affects the rating above gage height 5.0 feet.

Estimated monthly discharge of Muckalee Creek near Albany.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1903.			
March 9–31	3,420	2,020	2,[illegible]
April	3,840	1,250	2,[illegible]
May 1–14 and 24–31[a]	3,280	1,180	1,[illegible]
June	2,370	970	1,[illegible]
July	1,950	900	1,[illegible]
August	2,860	900	1,[illegible]
September 1–15 and 23–30[a]	3,700	675	1,[illegible]
October	1,110	770	[illegible]
November	2,020	770	1,[illegible]
December	1,880	1,180	1,[illegible]

[a] Discharges for missing days not given on account of backwater.

KINCHAFOONEE CREEK NEAR LEESBURG.

This station was established August 30, 1905, by F. A. Murray. It is located at the iron highway bridge 1 mile east of Leesburg, Ga.

The channel is nearly straight for about 400 feet above and below the station, and the current is mostly swift. The right bank is lower than the bridge and will probably overflow at times around the end of the bridge approach; the left bank will not overflow. The bed of the stream is sandy, and the current is good, except for a small amount of sluggish water at the left bank.

Discharge measurements are made from the downstream side of the single-span bridge. The initial point for soundings is the left end of the bridge.

The present gage is a temporary vertical rod, intended for low-water observations, which is attached to a cypress tree at the right edge of the water 150 feet above the bridge. It is read by J. M. Johnson. The bench mark is the top of the downstream end of the second floor beam from the left end of the bridge; elevation, 23.00 feet above the datum of the gage.

Discharge measurements of Kinchafoonee Creek near Leesburg.

Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*
August 30	0.98	7[illegible]
October 13	1.70	23[illegible]

Daily gage height, in feet, of Kinchafoonee Creek near Leesburg.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.						1905.					
1		1.0	1.8	1.45	1.7	17		1.1	1.4	1.8	
2		1.0	3.0	1.35		18		1.0	1.35	1.6	
3		1.1	2.9	1.3		19		1.0	1.3	1.55	
4		1.3	2.6	1.25		20		.9	1.25	1.5	
5		1.5	2.4	1.2		21		.8	1.2	1.4	
6		1.3	2.0	1.2		22		.8	1.2	1.4	
7		1.2	1.9	1.2		23		.7	1.2	1.4	
8		1.1	1.8	1.2		24		.7	1.2	1.4	
9		1.0	1.7	1.2		25		.7	1.2	1.4	
10		1.0	1.6	1.3		26		.6	1.2	1.5	
11		.9	1.6	1.9		27		.6	1.3	1.6	
12		.8	1.7	1.3		28		.6	1.5	1.7	
13		.7	1.8	2.8		29		.8	1.55	1.8	
14		.8	1.9	2.5		30	1.0	1.0	1.5	1.7	
15		.9	1.7	2.3		31	1.0		1.5		
16		1.0	1.6	2.0							

KINCHAFOONEE CREEK NEAR ALBANY.

This station was established as a temporary station March 9, 1903, by F. A. Murray, and was discontinued December 31, 1903. It was located at the wagon bridge 3 miles north of Albany, Ga., 200 feet below the Central of Georgia Railroad bridge and about one-half mile above the mouth of the creek.

The channel is curved both above and below the station. Both banks are high and all water passes beneath the bridge and its approaches. The bed is probably somewhat shifting.

Discharge measurements were made from the single-span highway bridge and its approaches, which cross the river at an angle to the direction of the current.

During 1905 the station was deeply covered with water by a large water-power development just below.

Discharge measurements of Kinchafoonee Creek near Albany.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1903.	*Feet.*	*Sec.-ft.*
March 9	2.25	1,206	May 22	3.32	1,682
March 26	3.25	1,920	July 2	1.84	944
April 18	2.82	1,741	September 19	3.29	2,051
July 19	1.59	714	October 15	.98	422
1902.			December 22	1.76	851
June 25	1.15	477	1904.		
September 27	1.20	999	June 18	.62	258
December 4	2.40	1,196	September 22	.65	296
1903.			November 16	1.12	535
March 6	4.28	3,886			

Gage heights for discharge measurements made during the years 1901 and 1902 were obtained by measuring down from the bench mark to surface of the water.

Daily gage height, in feet, of Kinchafoonee Creek near Albany.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	I
1903.										
1	.....	2.9	1.5	1.9	1.8	1.2	1.0	1.2	0.9	
2	.....	2.9	1.5	1.6	1.8	1.3	1.0	1.1	1.1	
3	.....	2.8	1.5	1.5	1.8	1.3	1.0	1.1	1.5	
4	.....	2.8	1.5	1.8	1.9	1.2	1.0	1.1	2.0	
5	.....	2.8	1.9	2.0	1.7	1.2	1.0	1.1	2.5	
6	.....	2.7	2.6	2.6	1.6	1.2	.9	1.1	2.8	
7	.....	2.6	2.6	2.9	1.7	1.3	.9	1.0	2.8	
8	.....	2.5	2.7	3.2	1.9	1.5	.9	1.0	2.7	
9	3.2	2.4	2.9	2.8	2.2	1.5	.9	1.0	2.5	
10	3.0	2.4	2.7	2.4	2.6	1.5	.8	1.0	2.3	
11	2.8	2.4	2.7	2.0	2.6	1.5	.8	1.0	2.2	
12	2.6	2.4	2.9	1.9	2.6	1.5	.8	.9	2.1	
13	2.4	2.5	3.1	1.7	2.6	1.6	.8	.9	2.1	
14	2.2	2.6	3.6	1.7	2.7	1.7	1.6	.9	2.1	
15	2.2	3.0	4.6	1.6	2.7	1.8	3.9	.8	2.0	
16	2.2	3.4	8.6	1.5	2.5	1.8	4.3	.8	2.0	
17	2.2	3.6	11.8	1.4	2.1	1.8	4.6	.8	2.0	
18	2.2	3.5	9.3	1.3	1.7	2.4	4.2	.8	2.0	
19	2.2	3.0	6.6	1.3	1.5	2.8	3.3	1.4	2.0	
20	2.2	2.8	5.2	1.3	1.3	3.2	2.9	1.4	2.0	
21	2.3	2.7	4.6	1.3	1.3	3.7	2.7	1.3	2.0	
22	2.3	2.6	3.7	1.2	1.2	3.9	2.5	1.3	2.0	
23	2.3	2.5	2.9	1.2	1.2	2.9	2.1	1.0	1.9	
24	2.4	2.4	2.7	1.4	1.2	2.2	1.5	.9	1.9	
25	2.4	2.2	2.6	1.5	1.2	1.9	1.4	.9	1.8	
26	2.5	2.0	2.3	1.4	1.3	1.7	1.3	.9	1.8	
27	2.5	1.8	2.0	1.5	1.4	1.5	1.3	.9	1.7	
28	2.5	1.7	1.9	1.5	1.5	1.3	1.3	.9	1.6	
29	2.6	1.7	2.0	1.6	1.3	1.1	1.2	.9	1.6	
30	2.7	1.6	2.0	1.8	1.3	1.1	1.2	.9	1.6	
31	2.8	.....	2.0	.....	1.3	1.0	.....	.9	.....	

Rating table for Kinchafoonee Creek near Albany from March 9 to December 31, 19

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	332	2.10	1,070	3.80	2,330	6.40	3,800
.90	381	2.20	1,135	4.00	2,490	6.60	3,900
1.00	432	2.30	1,200	4.20	2,630	6.80	4,000
1.10	485	2.40	1,265	4.40	2,760	7.00	4,100
1.20	539	2.50	1,330	4.60	2,880	7.50	4,350
1.30	594	2.60	1,400	4.80	3,000	8.00	4,600
1.40	650	2.70	1,470	5.00	3,100	8.50	4,850
1.50	707	2.80	1,540	5.20	3,200	9.00	5,100
1.60	765	2.90	1,615	5.40	3,300	9.00	5,350
1.70	824	3.00	1,690	5.60	3,400	10.00	5,600
1.80	884	3.20	1,850	5.80	3,500	11.00	6,100
1.90	945	3.40	2,010	6.00	3,600	12.00	6,600
2.00	1,007	3.60	2,170	6.20	3,700		

Estimated monthly discharge of Kinchafoonee Creek near Albany.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Me
1903.			
March 9–31	1,850	1,135	
April	2,170	765	
May	6,500	707	
June	1,850	539	
July	1,470	539	
August	2,410	432	
September	2,880	332	
October	650	332	
November	1,540	381	
December	1,400	765	

ICHAWAYNOCHAWAY CREEK AT MILFORD.

This station was established August 29, 1905, by F. A. Murray. It is located at the wagon bridge at Milford, 9 miles east of Leary, the railway point from which it is reached.

The channel is straight for 800 feet above and below the bridge. The current is moderately swift and is smooth except where it is broken by the bridge bents. Discharge measurements are made from the downstream side of the bridge, an old wooden structure supported by bents, six of which are in the water at ordinary stages. The initial point for soundings is the end of the hand rail at the left bank, downstream side.

The present gage is a temporary staff for low-water observations attached to the downstream post of the first bent from the left bank. It is read once each day by W. J. Kidd. Bench marks are as follows: (1) The top of the upstream cap of the first bent from the left bank; elevation, 15.00 feet. (2) A nail in a cypress tree at the left edge of the water, 30 feet below the bridge; elevation, 10.00 feet. Elevations refer to the datum of the gage.

Discharge measurements of Ichawaynochaway Creek at Milford.

Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*
August 29	2.89	364
October 16	3.05	386

Daily gage height, in feet, of Ichawaynochaway Creek at Milford.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.						1905.					
1	.....	2.8	3.2	3.05	2.95	17	.....	2.8	3.05	3.55	4.05
2	.....	2.8	3.4	3.0	2.9	18	.....	2.75	3.2	3.5	4.0
3	.....	2.8	3.5	3.0	2.9	19	.....	2.7	3.2	3.4	4.0
4	.....	2.75	3.6	3.0	2.95	20	.....	2.65	3.1	3.3	4.15
5	.....	2.7	3.6	3.1	3.0	21	.....	2.6	3.1	3.25	4.7
6	.....	2.7	3.7	3.1	3.1	22	.....	2.6	3.0	3.2	5.0
7	.....	2.65	3.7	3.15	3.25	23	.....	2.55	3.1	3.15	5.5
8	.....	2.6	3.5	3.25	3.4	24	.....	2.55	3.2	3.1	6.0
9	.....	2.6	3.1	3.35	3.5	25	.....	2.5	3.35	3.05	5.9
10	.....	2.55	3.15	3.4	3.6	26	.....	2.5	3.5	3.0	5.4
11	.....	2.55	3.2	3.45	3.65	27	.....	2.5	3.45	3.0	4.9
12	.....	2.7	3.3	3.5	3.7	28	.....	2.45	3.3	3.0	4.9
13	.....	2.9	3.4	3.55	3.9	29	2.9	2.62	3.2	3.0	4.7
14	.....	3.0	3.4	3.6	4.0	30	2.85	2.92	3.15	3.0	4.5
15	.....	3.0	3.2	3.6	4.05	31	2.8	.....	3.05	.....	4.4
16	.....	2.9	3.0	3.6	4.05						

MISCELLANEOUS DISCHARGE MEASUREMENTS IN APALACHICOLA RIVER DRAINAGE BASIN.

Beaverdam Creek.—This stream is a tributary of Soque River, entering from the right. A measurement was made May 13, 1904, from the bridge about 1 mile from Clarksville, on the road to Nacoo-

chee, Ga. The bench mark is the top of the brace from hand rail to large birch on the upper side of the bridge at the right bank, 12.00 feet above the datum of the gage.

Width, 22 feet; area, 12 square feet; mean velocity, 1.50 feet per second; gage height, 0.45 foot; discharge, 18 second-feet.

Big Potato Creek.—Before the section now adopted as a regular bench-mark station was found, two measurements of Big Potato Creek were made at the covered wagon bridge, 2½ miles from Thomaston, just below the Macon and Birmingham Railroad trestle. The bench mark is the top of the downstream lower stringer at sounding point 80. The elevation above gage zero is 15.00 feet.

January 15, 1904: Width, 82 feet; area, 188 square feet; mean velocity, 0.85 foot per second; gage height, 3.30 feet; discharge, 160 second-feet.

March 31, 1904: Width, 72 feet; area, 175 square feet; mean velocity, 0.74 foot per second; gage height, 3.25 feet; discharge, 130 second-feet.

Blue Spring.—This spring is of considerable local note. It is about one-half mile from the left bank of Flint River and about 4 miles below Albany, on the county road leading to Hardaway. Measurements were made from the foot log over the outlet of the main spring as follows:

April 19, 1904: Width, 25 feet; area, 45 square feet; mean velocity, 3.00 feet per second; gage height, 3.29 feet; discharge, 135 second-feet.

September 23, 1904: Width, 28 feet; area, 30 square feet; mean velocity, 1.47 feet per second; gage height, 2.85 feet; discharge, 44 second-feet.

November 16, 1904: Width, 22 feet; area, 21 square feet; mean velocity, 1.24 feet per second; gage height, 2.77 feet; discharge, 26.4 second-feet.

April 26, 1905: Width, 33 feet; area, 30 square feet; mean velocity, 2.30 feet per second; discharge, 69 second-feet.

Buck Creek.—This stream enters Flint River from the right about 1 mile west of Montezuma, Ga. A measurement was made August 23, 1905, at an old tramroad trestle about 1 mile above the mouth of the creek. The bench mark is the top of the upstream end of the cap of the first bent from the left edge of the stream; elevation, 12.00 feet above the datum of the assumed gage.

Width, 49 feet; area, 118 square feet; mean velocity, 1.42 feet per second; gage height, 2.20 feet; discharge, 167 second-feet.

Chattahoochee River.—A measurement was made September 25, 1905, from a boat held by cable stretched across the channels of the river about 8 miles upstream from Columbus and about 1½ miles above the mouth of Standingboy Creek. The bench mark is the top of a large wire nail which is driven into the base of an ash tree which stands about 25 feet below Narramore's spring branch; elevation, 5.00 feet above the datum of the assumed gage.

Width, 282 feet; area, 1,150 square feet; mean velocity, 0.98 foot per second; gage height, 1.75 feet; discharge, 1,125 second-feet.

Chickasawhachee Creek.—A measurement was made August 26, 1905, at McRainey Bridge, about 10 miles west of Newton, Ga. The initial point for soundings is the end of the bridge at the left bank, downstream side. The bench mark is the top of the downstream end of the middle bent of the bridge; elevation, 12.50 feet above the datum of the assumed gage.

Width, 35 feet; area, 38 square feet; mean velocity, 0.92 foot per second; gage height, 0.80 foot; discharge, 35 second-feet.

Coolawahee Creek.—A measurement was made August 28, 1905, from the downstream side of a wooden wagon bridge about 1 mile north of Newton, Ga. The bench mark is the top of the downstream end of the floor plank at a point 1 foot to the left of the center post; elevation, 11.50 feet above the datum of the assumed gage.

Width, 23 feet; area, 24 square feet; mean velocity, 1.62 feet per second; gage height, 0.70 foot; discharge, 25.5 second-feet.

Deep Creek.—This stream is a tributary of Soque River. A measurement was made May 13, 1904, from the wooden bridge on Burton road, about 3 miles from Clarksville.

Width, 25 feet; area, 26 square feet; mean velocity, 1.58 feet per second; discharge, 41 second-feet.

Elkins Creek.—Measurements were made during 1905 at a wooden wagon bridge 1 mile north of Thunder, Ga., about 200 feet below a small gristmill. As the flow at low water depends on the operation of the mill, the measured discharges do not give the natural flow of the stream. The bench mark is a notch and copper nails on the upstream main brace of the truss of the bridge, 8½ feet from the left end of the truss; elevation, 24.00 feet above the datum of the assumed gage.

April 21, 1905: Width, 42 feet; area, 38 square feet; mean velocity, 1.79 feet per second; gage height, 2.07 feet; discharge, 68 second-feet.

September 27, 1905: Width, 28 feet; area, 10 square feet; mean velocity, 0.73 foot per second; gage height, 1.45 feet; discharge, 7.3 second-feet.

Flint River.—A measurement was made September 24, 1904, from the wooden bridge 5 miles from Concord. The bench mark is the top of the first post from the right bank on the downstream side of the bridge, 12.00 feet above the datum of the gage.

Width, 92 feet; area, 184 square feet; mean velocity, 0.43 foot per second; gage height, 2.05 feet; discharge, 79 second-feet.

A measurement was made September 21, 1904, at the highway bridge, about 1 mile northwest of Montezuma. The bench mark is the top of the upstream pier at the left bank, which was 26.15 feet above the water surface. The gage height given is that taken from the temporary gage belonging to the United States Weather Bureau.

Width, 188 feet; area, 1,300 square feet; mean velocity, 0.75 foot per second; gage height, 10.63 feet; discharge, 971 second-feet.

A measurement was made September 20, 1905, at Parkers Bridge, about 7 miles west of Thomaston, Ga. The bench mark is the top of the upstream end of the first floor beam from the middle pier in the first iron span from the right bank; elevation, 35.00 feet above the datum of the assumed gage.

Width, 136 feet; area, 158 square feet; mean velocity, 1.39 feet per second; gage height, 5.00 feet; discharge, 219 second-feet.

Measurements were made at Powells Bridge, 3 miles above the regular gaging station at Woodbury. The bench mark is the top of the right upstream post of first pier from the right bank, 15.00 feet above the datum of the gage.

January 16, 1904: Width, 139 feet; area, 527 square feet; mean velocity, 1.39 feet per second; gage height, 5.88 feet; discharge, 730 second-feet.

September 22, 1904: Width, 116 feet; area, 332 square feet; mean velocity, 0.43 foot per second; gage height, 4.54 feet; discharge, 144 second-feet.

October 4, 1904: Width, 115 feet; area, 314 square feet; mean velocity, 0.34 foot per second; gage height, 4.40 feet; discharge, 107 second-feet.

April 21, 1905: Width, 143 feet; area, 479 square feet; mean velocity, 1.05 feet per second; gage height, 5.47 feet; discharge, 502 second-feet.

Hazel Creek.—This stream is a tributary of Soque River, entering from the left. Measurements were made from the bridge 1 mile from Demorest, on the road to Porter Mills. The bench mark is the top of the upper end of second floor beam from the right bank, 15.00 feet above the datum of the assumed gage.

May 13, 1904: Width, 25 feet; area, 30 square feet; mean velocity, 1.47 feet per second; gage height, 1.85 feet; discharge, 44 second-feet.

September 5, 1905: Width, 27 feet; area, 24 square feet; mean velocity, 1.37 feet per second; gage height, 0.82 foot; discharge, 33 second-feet.

October 23, 1905: Width, 27 feet; area, 20 square feet; mean velocity, 1.15 feet per second; gage height, 0.71 foot; discharge, 23 second-feet.

Ichawaynochaway Creek.—A measurement was made August 26, 1905, from the downstream side of Barnetts Bridge, 10 miles southwest of Newton, Ga. The initial point for soundings is the left end of the bridge approach, downstream side. The bench mark is the top of the downstream end of the second iron crossbeam from the left-bank pier; elevation, 29.50 feet above the datum of the assumed gage.

Width, 84 feet; area, 196 square feet; mean velocity, 2.62 feet per second; gage height, 1.30 feet; discharge, 513 second-feet.

A measurement was made August 26, 1905, from the downstream side of Rentz Bridge, about 12 miles west of Newton, Ga. The initial point for soundings is the end of the downstream hand rail at the left bank. The bench mark is the top of the downstream end of the cap of the bent which stands in the middle of the creek; elevation, 14.50 feet above the datum of the assumed gage.

Width, 76 feet; area, 355 square feet; mean velocity, 1.31 feet per second; gage height, 2.20 feet; discharge, 465 second-feet.

A measurement was made April 27, 1905, at the Central of Georgia Railway bridge, 1¼ miles from Williamsburg, Ga. The bench mark is the top of the downstream end of the third bent from the left bank; elevation, 20.00 feet above the datum of the assumed gage.

Width, 92 feet; area, 727 square feet; mean velocity, 1.06 feet per second; gage height, 7.66 feet; discharge, 767 second-feet.

Nickajack Creek.—This stream enters Chattahoochee River from the right, about 1 mile below the old gaging station at Oakdale. Measurements were made by wading about 100 feet above the Southern Railway bridge near Nickajack. The bench mark is the top of the second upstream iron girder from the left end of the bridge, 12 feet from the end, which rests on the center pier, 15.00 feet above the datum of the gage.

October 8, 1904: Width, 16 feet; area, 10 square feet; mean velocity, 1.00 foot per second; gage height, 0.92 foot; discharge, 10 second-feet.

October 8, 1904: Width, 16 feet; area, 11 square feet; mean velocity, 1.19 feet per second; gage height, 0.94 foot; discharge, 12.6 second-feet.

North Fork of Peachtree Creek.—A measurement was made May 20, 1904, from the Cheshire Bridge, 1½ miles above the Southern Railway bridge at Armour. The bench mark is the top of a bent nail in the bottom of the twelfth rail post from the right end of the bridge, 16.00 feet above the datum of the gage.

Width, 11 feet; area, 14 square feet; mean velocity, 1.71 feet per second; gage height, 0.90 foot; discharge, 24 second-feet.

Peachtree Creek.—This stream is a tributary of Chattahoochee River. A measurement was made May 20, 1904, from the Southern Railway bridge at Armour. The bench mark is the top of the middle stringer at its center on the downstream side of the bridge, 15.00 feet above the datum of the gage.

Width, 27 feet; area, 27 square feet; mean velocity, 1.22 feet per second; gage height, 0.17 foot; discharge, 33 second-feet.

Measurements were made at the wagon bridge 1 mile north of Brookwood, on the Peachtree road, and 6 miles north of Atlanta, Ga. The bench mark is the top of the iron plate on the first upright from the right end of the bridge, downstream side, 28.00 feet above the datum of the gage.

April 9, 1904: Width, 44 feet; area, 37 square feet; mean velocity, 1.54 feet per second; gage height, 1.12 feet; discharge, 57 second-feet.

May 20, 1904: Width, 43 feet; area, 25 square feet; mean velocity, 1.52 feet per second; gage height, 0.68 foot; discharge, 38 second-feet.

Peavine Creek.—This stream is the South Fork of Peachtree Creek. A measurement was made May 20, 1904, from the wooden bridge on the Cheshire Bridge road, about 1 mile east of Armour, Ga. The bench mark is the top of the head of the upper bolt used to bolt the

second rail post from the right end of the bridge to the stringer at the lower side of the bridge. Its elevation is 16.00 feet above the datum of the gage.

Width, 14 feet; area, 13 square feet; mean velocity, 1.23 feet per second; gage height, 0.85 foot; discharge, 16 second-feet.

Red Oak Creek.—This stream enters Flint River from the right, 3 miles above the regular gaging station on Flint River near Woodbury, Ga. Measurements were made at a wooden wagon bridge about 1 mile above the mouth of the creek. The bench mark is the top of the first post from the right-bank edge, downstream side, 15 feet from a large white-oak tree; elevation, 20.00 feet above the datum of the assumed gage.

January 16, 1904: Width, 68 feet; area, 134 square feet; mean velocity, 1.24 feet per second; gage height, 4.12 feet; discharge, 166 second-feet.

October 4, 1904: Width, 18 feet; area, 27 square feet; mean velocity, 0.68 foot per second; gage height, 2.65 feet; discharge, 18 second-feet.

September 27, 1905: Width, 32 feet; area, 12 square feet; mean velocity, 0.83 foot per second; gage height, 2.25 feet; discharge, 10 second-feet.

Rottenwood Creek.—This stream enters Chattahoochee River from the right. Measurements were made by wading at a point about 200 feet above the old Thornton dam, near Vinings, 2 miles above the mouth of the creek. The creek was believed to be at its lowest stage. The bench mark is a nail driven into rock on the right bank at the measuring section, marked "B. M." Its elevation is 3.00 feet above the datum of the gage.

October 4, 1904: Width, 9 feet; area, 6 square feet; mean velocity, 0.84 foot per second; gage height, 0.26 foot; discharge, 4.8 second-feet.

October 4, 1904: Width, 9 feet; area, 6 square feet; mean velocity, 0.82 foot per second; gage height, 0.26 foot; discharge, 4.9 second-feet.

October 4, 1904: Width, 9 feet; area, 6 square feet; mean velocity, 0.72 foot per second; gage height, 0.25 foot; discharge, 4.3 second-feet.

Soque River.—Measurements were made from Wall's bridge, 2½ miles above Clarksville. The bench mark is the top of a nail driven into a large leaning birch tree about 20 feet above the bridge on the left bank, 6.00 feet above the datum of the gage.

March 17, 1904: Width, 36 feet; area, 65 square feet; mean velocity, 1.83 feet per second; gage height, 1.35 feet; discharge, 119 second-feet.

March 17, 1904: Width, 36 feet; area, 63 square feet; mean velocity, 1.82 feet per second; gage height, 1.35 feet; discharge, 115 second-feet.

May 13, 1904: Width, 36 feet; area, 62 square feet; mean velocity, 1.92 feet per second; gage height, 1.45 feet; discharge, 119 second-feet.

Measurements were made at McHalister's bridge, about 7 miles from Cornelia and 1 mile above the mouth of the river. The bench mark is the top of the downstream end of the first wooden floor beam from the left bank, 22.00 feet above the datum of the gage.

March 18, 1904: Width, 74 feet; area, 152 square feet; mean velocity, 1.62 feet pe second; gage height, 1.85 feet; discharge, 246 second-feet.

July 16, 1904: Width, 72 feet; area, 88 square feet; mean velocity, 1.47 feet pe second; gage height, 1.25 feet; discharge, 130 second-feet.

Sweetwater Creek.—This stream enters Chattahoochee River from the right below the old station at Oakdale, Ga. A measurement was made March 15, 1904, at Adair's bridge, 2 miles north of Lithia Springs, and above the regular station on Sweetwater Creek near Austell, Ga. The bench mark is the top of the downstream end of the cap of first wooden bent from the left end of the bridge, 10.00 feet above the datum of the gage.

Width, 66 feet; area, 295 square feet; mean velocity, 1.37 feet per second; gage height, 1.50 feet; discharge, 404 second-feet.

A measurement was made March 15, 1904, at Ferguson's mill bridge, 5 miles from Austell. The bench mark is a nail driven into the river side of a birch tree on the right bank 12 feet below the bridge 5.00 feet above the datum of the gage.

Width, 129 feet; area, 484 square feet; mean velocity, 1.67 feet per second; gage height, 1.50 feet; discharge, 807 second-feet.

Warm Springs.—These springs are located one-half mile from Warm Springs, Ga., a station on the Southern Railway. Two discharge measurements were made March 10, 1905, about 300 feet below the springs and about 75 feet above the mouth of the branch, which is formed by the united flow of the several springs. April 20, 1905, two measurements were made about 6 feet below the end of the stone wall at the outlet from the bath house.

March 10, 1905: Width, 5 feet; area, 2.8 square feet; mean velocity, 1.14 feet per second; discharge, 3.2 second-feet.

April 20, 1905: Width, 4 feet; area, 1.52 square feet; mean velocity, 0.97 foot per second; discharge, 1.47 second-feet.

April 20, 1905: Width, 2.6 feet; area, 2.12 square feet; mean velocity, 0.69 foot per second; discharge, 1.48 second-feet.

White Oak Creek.—This stream enters Flint River from the right about 13 miles above the regular gaging station on Flint River at Woodbury, Ga. A measurement was made March 29, 1904, at the wagon bridge one-half mile west of Warnersville. The bench mark is the top of the first post on the downstream side of the bridge, 13.00 feet above the datum of the gage.

Width, 38 feet; area, 163 square feet; mean velocity, 0.71 foot per second; gage height, 1.25 feet; discharge, 115 second-feet.

A measurement was made March 29, 1904, at the double bridges one half mile from Riverview. The bench mark is the top of the first post 9.00 feet above the datum of the gage.

Width, 61 feet; area, 222 square feet; mean velocity, 0.50 foot per second; gage height, 2.36 feet; discharge, 112 second-feet.

Whitewater Creek.—This stream enters Flint River from the right. A measurement was made August 31, 1905, from the downstream side of a wooden highway bridge, locally known as the Lower Whitewater Bridge, about 4 miles northwest of Montezuma, Ga. The bench mark is the top of the downstream end of the cap of the third bent from the right bank; elevation, 12.00 feet above the datum of the assumed gage.

Width, 71 feet; area 275 square feet; mean velocity, 0.94 foot per second; gage height, 2.14 feet; discharge, 260 second-feet.

RIVER SURVEYS IN APALACHICOLA RIVER DRAINAGE BASIN.

CHATTAHOOCHEE RIVER.[a]

The elevations along Chattahoochee River are based on the following surveys:

The portion from Columbus to West Point was surveyed in August, 1902, by W. E. Hall, levelman, under the direction of B. M. Hall, United States Geological Survey. The portion from West Point to Franklin was surveyed in 1899 by the Corps of Engineers, United States Army. The portion from Franklin to Oakdale was surveyed in 1903 by Joseph Palmer, levelman, under the direction of Fred A. Franck, United States Geological Survey. The elevations along this part of the stream are based on an aluminum tablet at the Washington street entrance to the State capitol building at Atlanta, marked "1050 M. C." The portion from Oakdale to the mouth of Chestatee River was surveyed in 1902 by Felder Furlow, levelman, under the direction of B. M. Hall, United States Geological Survey. The elevations between the mouth of Chestatee River and Nacoochee were determined in 1903 by Joseph Palmer, levelman, under the direction of F. A. Franck, field assistant, United States Geological Survey. These elevations are based on an aluminum tablet at Nacoochee, marked "1439 Atlanta", in the ledge of rock 200 feet west of ford of Chattahoochee River, the elevation of which is now accepted as 1,348.259 feet above main sea level. The adjustment of this line was accomplished in conjunction with leveling on the Chestatee and Soque rivers, tied at Willow and Clarksville, and by an extra check at Pole, to primary level circuits, and accords with the 1903 adjustment of the precise level net.

In order to give a continuous profile of the river, the levels of these several surveys have been adjusted to accord with the elevations determined for the portion between Franklin and Oakdale. It is not expected, however, that the bench marks of one survey will exactly accord with those of another.

[a] For survey of Chattahoochee River from junction with Flint River to Columbus, Ga., see Report of Chief of Engineers, U. S. A., 1872, pp. 584, 623; and Report of Chief of Engineers, U. S. A., 1873, pp. 689–700.

Elevations on Chattahoochee River from Columbus up to Nacoochee.

Description of points.	Elevation above sea level.
	Feet.
Tail water 100 feet below Eagle and Phoenix dam tailrace	190
Above Eagle and Phoenix dam, water surface	216.2
100 feet below City Mills dam, water surface	216.6
Above City Mills dam, water surface	225
100 feet below Columbus Power Company's dam, water surface	226
Top of Columbus Power Company's dam, water surface	266
Bench mark on solid rock on east bank at lower land line of Chattahoochee Falls Company's property	270.75
Upper end of Columbus Power Company's backwater from dam, water surface	266
600 feet below old Clapp factory, water surface	276
Above old Clapp factory, water surface	300.3
Mouth of Roaring Creek (from Georgia bank), water surface	300.6
Water at upper line of Chattahoochee Falls Company's property, water surface	305.3
Bench mark on root of small water-oak tree on east bank of river, 400 feet below mouth of Standingboy Creek	321.6
Mouth of Standingboy Creek, water surface	315.6
Upper end of Narramores Island, water surface	316.1
Bench mark on mulberry tree, 40 feet below wire fence between Narramore and Biggers	328.71
Land line between Narramore and Biggers, water surface	317.6
Bench mark on large water oak 10 feet below land line between J. L. and B. A. Biggers	332.64
Land line between J. L. and B. A. Biggers, water surface	318.2
Ford to island, water surface	319.7
Water surface	323.4
Opposite mouth of creek from west bank, water surface	323.5
Lower end of Allie Biggers's island, water surface	323.6
Land line between Allie Biggers and Geo. Ogletree, water surface	323.7
Upper end of Allie Biggers's island, water surface	324.7
Bench mark on large maple on bank opposite foot of shoals on Ogletree's land	340.52
Foot of shoals on Ogletree's land, water surface	326.5
Water surface	330.5
Bench mark on large ironwood tree near water	337.95
Water surface	333.3
....do	334.3
Bench mark on large dead cedar 10 feet below mouth of Cowpen Creek	351.19
Mouth of Cowpen Creek, water surface	345.9
Water surface	349.4
....do	350.1
....do	351.1
Bench mark on pine tree 75 feet below mouth of Mulberry Creek	367.23
Mouth of Mulberry Creek, water surface	362.8
Water surface	366.5
....do	368.2
....do	375.9
Near mouth of Sue Slaton Branch, water surface	390.6
Bartletts Ferry, water surface	394.7
Water surface	400
Mouth of Mossy Creek, water surface	411.8
Lower end of Harrington Island, water surface	431
Water surface	442.5
Lower end of Phipps Island, water surface	443.6
Water surface	461.3
....do	467.1
Lower end of Hargetts Island, water surface	475.8
Mouth of Mountain Oak Creek, water surface	480.7
Water surface	482.5
Foot of shoals, water surface	482.6
Blantons Ferry, water surface	484.1
Houstons Ferry, water surface	491.3
Below River View dam, west side, water surface	518
Above River View dam, water surface	529
Below dam at Langdale mills, water surface	532
Top of dam or water above dam	542
Water surface	550
West Point milepost 38, from Franklin	565.14
West Point, zero of gage	549.46
West Point, wagon bridge, water surface (gage height, 2.0 feet)	551.5
Mouth of Osceligee Creek, water surface	555.9
Milepost 37, from Franklin	571.15
Water surface	556.6
Milepost 36, from Franklin	572.68
Water surface	556.9
Water at mouth of Anderson Creek	557.6
Milepost 35, from Franklin	577.94
Water surface	558.2
Opposite mouth of Maple Creek, east	558.9
Milepost 34, from Franklin	571.95
Water surface	560.8
Milepost 33, from Franklin	575.60

Elevations on Chattahoochee River from Columbus up to Nacoochee—Continued

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
40.0	Head of Hendersons Island, water surface	561
40.3	Potts Island, water surface	562.5
41.0	Milepost 32, from Franklin	574.3
41.0	Water surface	564.4
42.0	Milepost 31, from Franklin	575.6
42.0	Water surface	568.1
42.2	Lower end Hughleys Island, water surface	568.7
43.0	Milepost 30, from Franklin	582.3
43.0	Upper end Hughleys Island, water surface	572.8
43.5	Mouth of Wohadkee Creek, west side, water surface	577.1
44.0	Milepost 29, from Franklin	591.7
44.0	Water surface	575.1
44.5	Hunters old ferry, water surface	576.9
45.0	Milepost 28, from Franklin	580.0
45.0	Water surface	570.9
45.3	Double Mills bridge, water surface	576.9
46.0	Milepost 27, from Franklin	592.2
46.0	Water surface	579.9
47.0	Milepost 26, from Franklin	590.6
47.0	Water surface	586
48.0	Milepost 25, from Franklin	588.6
48.0	Water surface	580.7
48.5	Mouth of Whitewater Creek, water surface	580.8
49.0	Milepost 24, from Franklin	595.5
49.0	Water surface	586.2
50.0	Milepost 23, from Franklin	597.6
50.0	Water surface	583
50.5	McGees Bridge, water surface	583.1
51.0	Milepost 22, from Franklin	598.29
51.0	Opposite mouth of Yellow Jacket Creek, east side, water surface	583.4
51.3	Lower end of Birdsay Island, water surface	584.1
51.8	Upper end of Birdsay Island, water surface	586.6
51.9	Lower end of Reids Island, water surface	586.9
52.0	Milepost 21, from Franklin	603.9
52.0	Water surface	586.9
52.8	Upper end of Reids Island, water surface	587
53.0	Milepost 20, from Franklin	600.77
53.0	Water surface	589.9
54.0	Milepost 19, from Franklin	609.52
54.0	Water surface	591.3
54.3	Head of shoals, water surface	592.9
55.0	Milepost 18, from Franklin	609.34
55.0	Water surface	593.7
55.3	.....do	594
56.0	Milepost 17, from Franklin	602.25
56.0	Water surface	595.4
56.3	Mouth of Wolf Creek, water surface	595.1
57.0	Milepost 16, from Franklin	613.77
57.0	Water surface	598.2
57.9	Moodys Bridge, water surface	596.8
58.0	Milepost 15, from Franklin	615.39
58.0	Water surface	597.1
59.0	Milepost 14, from Franklin	615
59.2	Mouth of Haralson Creek, water surface	599.4
59.9	Lower end of Swanson Island, water surface	599.6
60.0	Milepost 13, from Franklin	616.99
60.0	Water surface	599.9
60.5	Upper end of Swanson Island, water surface	600.9
61.0	Milepost 12, from Franklin	618.32
61.0	Water at head of Swanson Shoals, water surface	605.2
61.4	Water surface	605.9
62.0	Milepost 11, from Franklin	622.15
2.06	Water surface	607.3
62.5	.....do	607.7
63.0	Milepost 10, from Franklin	630.21
63.0	Water surface	606
64.0	Milepost 9, from Franklin	627.71
64.0	Water surface	608.2
64.1	Opposite mouth of Potato Creek, east side, water surface	608.1
64.5	Philpots Ferry, water surface	609.2
64.8	Opposite mouth of New River, from east side, water surface	609.3
65.0	Milepost 8, from Franklin	634.46
65.0	Water surface	609.6
65.5	.....do	609.6
66.0	Milepost 7, from Franklin	628.59
66.0	Water surface	610.4
66.2	Foot of Jacksons Shoals, water surface	610.4
66.7	Mouth of Brushy Creek, from west side, water surface	611.5
67.0	Milepost 6, from Franklin	628.13
67.0	Water surface	613

Elevations on Chattahoochee River from Columbus up to Nacoochee—Continued.

Description of points.	Elevation above sea level.
	Feet.
Mouth of branch, water surface	618
Head of Jacksons Shoals, water surface	618.7
Milepost 5, from Franklin	629.75
Water surface	618.7
Milepost 4, from Franklin	631.45
Foot of Linville Shoals, water surface	618.7
Head of Linville Shoals, water surface	620
Milepost 3, from Franklin	637.91
Water surface	620.8
Mouth of Hillabeehatchee Creek, west side, water surface	621.7
Milepost 2, from Franklin	636.01
Water surface	622
....do	622.4
Milepost 1, from Franklin	636.10
Water surface	623.1
....do	624.6
....do	625
Milepost 0, from Franklin	634.86
Franklin, above bridge, water surface	626
Franklin, rivet on top of left iron pier, east approach, wagon bridge	655.17
Franklin, water surface	626
Franklin, bronze tablet, marked "695 A," in south side of court-house	694.742
Foot of shoals, surface of water	627
Centralhatchee Creek, birch tree opposite mouth	633.49
Water surface	628
Foot of shoal, water surface	628
Head of shoal, water surface	632
Foot of shoal, water surface	632
Head of shoal, water surface	634
Foot of shoal, water surface	634
Head of shoal, water surface	638
Bushyhead Shoals, white oak opposite foot	648.15
Water surface	638
Head of Bushyhead Shoals, birch at head of island	653.32
Water surface	645
Head of shoal, water surface	658.73
Water surface	650
Fishtrap Shoal, foot of, water surface	648
Fishtrap Shoal, elm tree on rock bluff opposite center	670.26
Water surface	652
Fishtrap Shoal, head of, water surface	657
Sweet gum, right bank, one-fourth mile below Pink Creek	664.97
Water surface	658
Mouth of Pink Creek, water surface	658
Hollingsworth Ferry, water oak, right bank	673.31
Hollingsworth Ferry, water surface	658
Bench mark on pine	678.8
Water surface	659
Mouth of Yellow Dirt Creek, water surface	660
Sweet gum tree one fourth mile above Yellow-Dirt Creek	679.8
Water surface	662
Browns Ferry, walnut tree, right bank	681.96
Browns Ferry, water surface	662
Birch tree on right bank at mouth of Whooping Creek	670.2
Water surface	664
Foot of small shoal, water surface	666
Head of small shoal, water surface	667
Culpepper Creek, red oak on right bank at mouth	678.04
Water surface	667
Foot of McIntosh Shoal, sweet-gum tree	679.49
Water surface	668
Head of McIntosh Shoal, water surface	676
Houstons Ferry, foot of shoal, catalpa tree	684.02
Water surface	677
Head of Hanson Shoal, water surface	678
Foot of Friesdell Shoal, water surface	679
Head of Friesdell Shoal, water surface	680
Foot of small shoal, water surface	681
Head of shoal just below Rees Ferry, water surface	682
Rees Ferry, ash tree, right bank	693.86
Water surface	682
Poplar tree, one-half mile below Central of Georgia Railway bridge	690.76
Water surface	682
Willow on right bank, 40 feet above Central of Georgia Railway bridge	692.12
Water surface	684
Foot of shoals, water surface	684
Head of shoals below Moores Ferry, water surface	685
Moores Ferry, large birch, right bank	702.85
Moores Ferry, water surface	686
Foot of shoal below Snake Creek, water surface	687
Willow tree, 100 yards above mouth of Snake Creek	696.72

Elevations on Chattahoochee River from Columbus up to Nacoochee—Continu

Distance.	Description of points.	Ele abo
Miles.		
100.5	Water surface	
102.0	Water oak opposite lower end of island	
102.0	Water surface	
102.9	Pine opposite head of island, right bank	
102.9	Water surface	
104.6	Hutchinson Ferry, maple on right bank, 20 feet from river	
104.6	Hutchinson Ferry, water surface	
105.9	Foot of Mederis shoal, mouth Wolf Creek, water surface	
106.2	White oak, side of rock bluff, right bank	
106.2	Water surface	
106.6	Head of Mederis Shoal, water surface	
106.9	Foot of Ballard Shoal, water surface	
107.1	Head of Ballard Shoals, willow 10 feet from river, right bank	
107.1	Water surface	
108.4	Jones Ferry, pine tree on left bank	
108.4	Jones Ferry, water surface	
109.9	Defers Ferry, large birch on left bank	
109.9	Defers Ferry, water surface	
111.4	Walnut about 2 miles below Big Bear Creek, and near a point opposite mouth of Dog River	
111.4	Water surface	
112.5	One mile below Big Bear Creek, water surface	
113.5	Poplar at mouth of Big Bear Creek	
113.5	Water surface	
114.6	Pumpkintown Ferry, large birch left bank, 15 feet from river	
114.6	Pumpkintown Ferry, water surface	
116.0	Riverton Ferry, sycamore 10 feet from river on left bank	
116.0	Riverton Ferry, water surface	
116.3	Mouth of Pea Creek, water surface	
116.7	Foot of Redmans Shoal, water surface	
116.8	Head of Redmans Shoal, sycamore on left bank, 10 feet from river	
116.8	Water surface	
117.4	Brocks Ferry, white oak on left bank, 10 feet from river	
117.4	Brocks Ferry, water surface	
119.1	One mile below Campoellton Ferry, water surface	
120.1	Campbellton Ferry, sycamore 10 feet from river, left bank	
120.1	Campbellton Ferry, water surface	
121.0	Walnut on left bank, one-fourth mile below Camp Creek	
121.0	Water surface	
121.4	Mouth Camp Creek, ash tree, left bank	
121.4	Water surface	
123.2	Walnut, on left bank, 70 feet from river	
123.2	Water surface	
123.7	Water surface	
125.2	Dupres Ferry, elm tree on left bank	
125.2	Dupres Ferry, water surface	
126.7	Large walnut on left bank	
126.7	Water surface	
127.7	Aderholts Ferry large sycamore opposite mouth of Sweetwater Creek	
127.7	Aderholts Ferry, water surface	
129.6	Sweet gum, left bank	
129.6	Water surface	
130.6	Walnut on left bank, just above Buzzard Roost Island	
130.6	Water surface	
131.6	Walnut on left bank, opposite a point near the mouth of Landers Creek	
131.6	Water surface	
132.6	Walnut, 40 feet from river, left bank	
132.6	Water surface	
133.9	Garretts Bridge, water oak, left bank	
133.9	Garretts Bridge, water surface	
134.6	Sycamore, 10 feet from left bank, at old ferry	
134.6	Water surface	
135.5	Mouth of Nickajack Creek, water surface	
136.4	Three hundred feet below Mason and Turners Ferry and 200 feet from river, hickory tree, left bank	
136.4	Water surface	
137.5	Near mouth of Proctors Creek, willow tree, left bank	
137.5	Water surface	
138.0	Oakdale, United States Geological Survey gaging station, water surface (gage 1.7	
138.0	Oakdale, zero of gage at Southern Railway bridge	
138.6	Water surface	
140.1	White oak, 50 feet from river, 70 feet below mouth of Peachtree Creek	
140.1	Mouth of Peachtree Creek, from east bank, water surface	
140.6	Mouth of small branch, water surface	
141.1	Rock bluff, east bank, water surface	
141.5	Water surface	
141.7	Foot of shoals, water surface	
141.8	Water surface	
142.1	Water surface	
142.5	Paces Ferry, willow tree, upper side of east bank landing	

Elevations on Chattahoochee River from Columbus up to Nacoochee—Continued.

e.	Description of points.	Elevation above sea level.
s.		*Feet.*
	Paces Ferry, water surface	752.7
	Water surface	752.9
	Birch tree at mouth of Little Nancy Creek, west bank of river, lower bank of creek.	768.06
	Water surface	754
	Lower end of Long Island (Thornton place), water surface	755.2
	Water surface	757.3
	Pace's mill site, water surface	759.5
	Large ash tree at mouth of Rottenwood Creek, lower side of creek	771
	Water surface	762
	Opposite mouth of Long Island Creek, water surface	764.3
	Water surface	764.4
	Sweet-gum tree at "The Narrows"	765.71
	Water surface	770.3
	Water surface	772.4
	Water surface	776.8
	Water surface	780.6
	Powers Ferry, white oak tree, west bank	794.21
	Water surface	780.8
	Land line between Power and McKenzie	787.2
	Heards Ferry, forked ash tree, mouth of Soap Creek, lower bank	799.46
	Heards Ferry, water surface	790.3
	Johnsons Ferry, large water oak tree, west landing, downstream side of road. (This is old bench mark marked 118.52)	806
	Johnsons Ferry, water surface	793.3
	Dam site, Bull Sluice water power (dam is being built here), water surface	800
	Water surface	803.6
	Water surface	804.8
	Water surface	806.2
	Large red oak, 150 feet from river, and 200 feet below Power's old mill	837.66
	Water surface	820.4
	Above Power's old mill dam, water surface	823.6
	Water surface	824.5
	Water surface	829.2
	Water surface	829.5
	Birch, mouth of Willioe Creek, upper bank	836.04
	Water surface	831.4
	Water surface	835.3
	Large water oak above mouth of branch	842.12
	Mouth of branch, west bank of river, water surface	835.9
	Water surface	839.1
	Water surface	841
	Water surface	843.9
	Water surface	846.1
	Mouth of Vickerys Creek, sweet gum tree, lower bank of creek	851.78
	Water surface	849.6
	Near mouth of Seven Creek, water surface	852.6
	Foot of Ford Island, water surface	855.4
	Water surface	857.3
	Water surface	859
	Water surface	859.1
	Letts Ferry root of 4 willows upper side, west landing	866.97
	Water surface	862
	Water surface	862.5
	Water surface	862.7
	Nesbits Ferry, large birch, west landing	870.65
	Nesbits Ferry, water surface	863.2
	Holcombs Ferry, water oak at west landing, 50 feet from river, upper side of road	881.17
	Holcombs Ferry, water surface	865.6
	Water surface	867.8
	Mouth Holcombs Mill Branch, west side river	869.2
	Water surface	869.9
	Water surface	874
	Foot of Jones Shoals, water surface	875.6
	Head of Jones Shoals, water surface	880.5
	Jones Ferry, large oak, west landing, 50 feet from river	886.5
	Jones Ferry, water surface	880.5
	Water surface	880.7
	Medlocks Bridge, top of iron tubular pier west bank, downstream	906.40
	Medlocks Bridge, water surface	880.7
	West landing of McClure or Warsaw Ferry, birch 100 feet from bank	897.40
	Water surface	882
	Abbotts Ferry, water surface	884
	Rogers Ferry, large beech tree, west landing, on downstream side of road	894.78
	Rogers Ferry, water surface	885.7
	Littles Ferry, west landing, twin persimmon tree 100 feet from bank, on downstream side of road	905.35
	Littles Ferry, water surface	889.3
	Hutchins Ferry, west landing, large walnut tree 150 feet from bank, on downstream side of road	914.69
	Hutchins Ferry, water surface	895.6

Elevations on Chattahoochee River from Columbus up to Nacoochee—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
177.7	Terrys Ferry, sycamore tree at upper side of west landing	906.2
177.7	Terrys Ferry, water surface	894.8
180.13	Stricklands Bridge, top of stone pier, west bank	933.4
180.3	Stricklands Bridge, center of pulley of wire gage (U. S. G. S. gage; height at time, 1.1 foot)	936.34
180.3	Water surface	923.9
180.3	Walnut on edge of road, 75 feet from approach of bridge, west side of river	930.4
180.9	Mouth of small branch from west side, water surface	903.4
182.4	Parker Ferry (no longer used as ferry), water surface	915.4
182.9	Water surface	915
183.3	Water surface	915.3
183.5	Head Winding Shoals at upper end of island, water surface	921.2
184.0	Pirkles Ferry, poplar tree on edge of road near west landing	922.2
184.0	Water surface	922.2
184.5	Forked hickory tree on Pirkle's upper land line, 50 feet from west bank of river	948.2
184.5	Water surface	926.9
185.1	Water surface	927.5
186.0	Shadburns Ferry, sycamore tree, west landing	935.9
186.0	Water surface	926.4
189.0	Walnut tree 100 feet west of bank at Light's old ferry place	936.6
189.8	Top of cylindrical iron pier, downstream, east bank, wagon bridge opposite Flowery Branch	951.6
189.8	Water surface	920.3
190.9	Water surface	920.2
192.9	Below dam at gristmill, water surface	944.4
192.9	Above dam at gristmill, water surface	953.3
192.9	Oak tree just above gristmill, on east side of river	960.7
192.9	Browns Bridge, water surface	953.3
193.5	Near Brown's house, west side of river, water surface	952.7
193.8	Mouth of Brown Creek from west side, water surface	954
195.4	Near Keiths Bridge, mouth of Chestatee River, nail in root of walnut tree	964.2
	Head of shoals above mouth of river, water surface	956
197.1	Nail in root of walnut tree, north bank	969.7
199.1	Foot of shoals, water surface	960
199.1	Head of shoals, water surface	963
	Nail in root of large walnut tree at edge of public road opposite small shoal	965.4
201.1	Water surface	963
201.6	Water surface	966
202.2	Iron bridge, nail in root of large walnut tree	960.3
202.2	Foot of shoals, water surface	967
202.7	Head of shoals, water surface	972
203.7	Thompson Bridge, nail in root of large walnut tree	966.3
203.7	Thompson Bridge, water surface	977
204.8	Little River, foot of shoals at mouth, water surface	978
204.8	Head of shoals, water surface	984
205.4	Nail in root of white oak on north side of bluff, 100 yards below North Georgia Electric Company's new dam	1,004.84
205.4	Water surface	986
206.4	Chattahoochee Park, nail in birch tree on east side of river and at sharp bend	1,004.2
	Foot of shoals, water surface	986
	Head of shoals, water surface	1,010
207.6	Spike in root of large oak tree near small store building near Gainesville	1,026.1
207.6	Bridge, water surface	1,011
208.6	Nail in root of willow on south bank 6 feet from water	1,014.84
208.6	Water surface	1,012
209.3	Foot of shoals, water surface	1,012
	Head of shoals, water surface	1,014
211.6	Clarks Bridge, east side of river, large maple tree, nail in root of	1,039.8
211.6	Clarks Bridge, water surface	1,017
212.6	Small bluff, north side of river, poplar tree, nail in root of	1,045.2
212.6	Water surface	1,020
214.6	Red-oak tree, nail in root of	1,043.5
	Foot of shoals, water surface	1,025
214.9	Foot of shoals, water surface	1,028
	Head of shoals, water surface	1,032
216.6	Savage Ferry, nail in notch of oak post	1,051.3
216.6	Water surface	1,034
217.6	Left bank of river, nail in root of birch tree	1,050.4
217.6	Water surface	1,037
219.3	North bank of river, nail in root of water oak tree	1,040.7
219.3	Water surface	1,038
219.3	Head of shoals, water surface	1,040
220.3	Seven Island Shoals, opposite foot of, large poplar tree, nail in root of	1,068.94
	Foot of shoals, water surface	1,040
	Head of shoals, water surface	1,044
221.0	Flat Creek, 1 mile above mouth of, nail in root of poplar tree	1,045.64
221.0	Water surface	1,045
221.9	Lulu Bridge, 60 feet below, on north bank of river, red oak tree, nail in root of	1,065.6
221.9	Water surface	1,049
224.2	Walnut tree in large open bottom, left bank of river, nail in root of	1,076.2

Elevations on Chattahoochee River from Columbus up to Nacoochee—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
224.2	Water surface	1,053
225.2	Belton Bridge, 100 yards below, right bank of river, walnut tree, nail in root of	1,076.64
225.2	Water surface	1,056
227.2	Right bank of river, pine tree, nail in root of	1,092.99
227.2	Foot of shoals, water surface	1,061
227.3	Head of shoals, water surface	1,089
228.0	Nail in root of birch tree	1,085.79
228.0	Water surface	1,070
	Foot of shoals, water surface	1,071
	Head of shoals, water surface	1,073
228.5	Head of shoals, on side of bluff, large pine opposite, nail in root of	1,092.83
228.5	Water surface	1,082
228.6	Harrisons Shoals, foot of, water surface	1,084
229.5	Harrisons Shoals, opposite, nail in root of oak tree	1,101.7
229.5	Harrisons Shoals, water surface	1,087
	Harrisons Shoals, head of, mouth of Mossy Creek, water surface	1,087
229.6	Mountain Island Shoals, foot of, water surface	1,088
	Head of shoals, water surface	1,096
229.9	Head of shoals opposite, nail in root of white oak	1,109.78
230.6	Foot of shoals, water surface	1,101
230.6	Head of shoals, water surface	1,106
230.6	Perkins Shoals, opposite foot of, nail in root of water oak	1,113.68
230.6	Perkins Shoals, foot of, water surface	1,107
	Perkins Shoals, head of, water surface	1,113
232.7	Foot of shoals, water surface	1,115
	Head of shoals, water surface	1,123
232.8	Head of shoals, north bank of river, opposite, nail in root of black gum tree	1,127.76
233.6	Foot of shoals, water surface	1,127
233.6	Head of shoals, water surface	1,130
233.7	Duncans Bridge, 30 feet below, nail in red oak tree	1,148.9
233.8	Foot of shoals, water surface	1,131
234.0	Head of shoals, water surface	1,135
234.0	Head of shoals, opposite, nail in root of water oak	1,155.41
234.7	Soque River, south bank, at mouth, nail in root of birch tree	1,147.82
234.7	Water surface	1,137
234.7	Soque River, mouth of, in forks of river, nail in root of pine stump	1,148.86
235.0	Head of shoals, water surface	1,144
235.2	Foot of snoals, water surface	1,149
235.4	Head of shoals, water surface	1,159
235.4	Head of shoals, opposite, on west bank of river, nail in root of red oak	1,165.2
235.9	Long Shoals, head of, water surface	1,178
236.2	Foot of shoals, water surface	1,178
	Head of shoals, water surface	1,216
237.2	Head of shoals, root of hickory tree	1,222.10
237.7	Irwins Bridge, 10 feet below, left bank of river, nail in root of poplar tree	1,223.37
237.7	Water surface	1,216
238.0	Irwins Bridge, just above, water surface	1,222
238.6	Head of shoals, water surface	1,228
238.9	Foot of shoals, water surface	1,229
	Head of shoals, water surface	1,242
238.9	Blue Creek, water surface	1,243
239.0	Blue Creek, 100 yards below mouth of, nail in root of red oak tree	1,256.09
239.6	Amos Ford, on west bank, large birch tree, nail in root of	1,256.09
239.6	Amos Ford, water surface	1,244
239.9	Water surface	1,247
240.4	Head of shoals, water surface	1,250
241.4	Allens Bridge, west end of, red oak tree, nail in root of	1,266.49
241.4	Allens Bridge, water surface	1,256
	Head of shoals, water surface	1,259
242.2	Foot of shoals, water surface	1,260
	Head of shoals, water surface	1,263
242.2	Head of shoals, opposite, nail in root of birch tree	1,264.18
242.7	Foot of shoals, water surface	1,271
	Head of shoals, water surface	1,274
242.9	Shoals, opposite, head of, nail in root of pine tree	1,280.73
243.9	Foot of shoals, water surface	1,276
244.4	Head of shoals, water surface	1,280
244.4	Shoals, red oak, opposite head of, nail in root of	1,285.53
244.6	Sharp bend of river, water oak tree, nail in root of	1,304.53
	Water surface	1,292
245.9	Suspension footbridge, poplar tree at, nail in root of	1,305.97
245.9	Water surface	1,297
247.2	Foot of shoals, water surface	1,299
	Head of shoals, water surface	1,306
248.4	Sautee Creek, near mouth of, in Nacoochee Valley, water surface	1,309
250.4	Sautee Creek, ford near mouth, water surface	1,339
250.4	Nacoochee post-office, 200 feet west of ford of Chattahoochee River, 6 feet above surface of road, on ledge of rock aluminum tablet marked "1349 Atlanta"	1,348.269

SURVEY OF SOQUE RIVER.

The elevations in the following list are based on an aluminum table at the north side of east entrance to the court-house at Clarksville, marked "1372 ATLANTA," the elevation of which is accepted as 1,371.991 feet above mean sea level in accord with the 1903 adjustment of the precise level net.

The leveling was done by Joseph Palmer, levelman, in September, 1903, under the direction of F. A. Franck, field assistant, United States Geological Survey.

Elevations on Soque River from mouth up to Clarksville.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0.0	Soque River, mouth, at junction with Chattahoochee River, nail in root of birch tree, on south bank	1,147.[illegible]
0.0	Soque River, mouth of, water surface	1,137
1.6	McAllisters Bridge, near north end, nail in root of white oak tree	1,15[illegible]
1.6	McAllisters Bridge, water surface	1,1[illegible]
	Foot of shoals	1,1[illegible]
	Head of shoals	1,1[illegible]
4.0	New Bridge, hickory on north bank, nail in root	1,171 [illegible]
4.0	New Bridge, water surface	1,152
4.1	Foot of shoals, water surface	1,153
	Head of shoals, water surface	1,156
4.7	Foot of shoals, water surface	1,1[illegible]
	Head of shoals, water surface	1,162
5.6	Foot of shoals, water surface	1,1[illegible]
5.7	Head of shoals, water surface	1,181
6.1	Porters mills, foot of Porter Shoals, water surface	1,189
6.1	Head of Porters Shoals, water surface	1,237
6.1	Near north end of wagon bridge, red oak tree, nail in root of	1,2[illegible]
6.2	Foot of upper shoals, water surface	1,2[illegible]
	Head of upper shoals, water surface	1,253
6.3	200 yards above factory, near river, on root of water oak	1,2[illegible]
7.3	Foot of shoals, water surface	1,281
7.3	Left bank of river, nail in root of sycamore tree	1,287 [illegible]
7.3	Water surface	1,284
8.8	Clarksville, Habersham County court-house, on north side of east entrance, aluminum tablet marked "1372 ATLANTA"	1,371.[illegible]
8.8	Clarksville, water surface	1,289

SURVEY OF CHESTATEE RIVER.

The elevations in the following list are based upon a bronze tablet 2.5 miles north of Willow, in rock on the west side of the river at a fork of the road, marked "1529 ATLANTA," the elevation of which is accepted as 1,528.649 feet above mean sea level in accord with the 1903 adjustment of the precise level net.

The leveling was done by Joseph Palmer, levelman, in October, 1903, under the direction of F. A. Franck, field assistant, United States Geological Survey.

Elevations on Chestatee River from mouth to Willow.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0.0	Bench mark, nail in root of walnut tree near Keiths Bridge, mouth of Chestatee River, near Chestatee	964.37
1.1	Bench mark, nail in red-oak tree, 40 feet from east bank, near mouth of branch	981.76
3.1	Walnut tree, nail, 20 feet from river, in open field	975.87
3.1	Water surface	960
4.3	Water surface	963
5.1	Sycamore tree, nail, east bank of river	974.48
5.1	Water surface	964
6.8	Water surface	970
6.9	Root of red-oak tree, nail, 40 feet below mouth of Langleys Creek, east side	989.34
6.9	Water surface	972
7.8	Foot of dam at mill, water surface	977
7.8	Top of dam at mill, water surface	983
7.9	Top of iron bolt, west side of east approach, painted white	1,001.28
7.9	Water surface	984
8.1	Root of pine stump, nail, near Boldings Bridge, 50 feet from river, east bank	999.56
8.9	Red-oak tree, nail in root, 40 feet from river, east bank	1,003.69
9.2	Mouth of small creek, water surface	986
10.8	Water surface	993
	Foot of dam, water surface	1,000
11.0	Top of dam, water surface	1,003
11.9	Foot of shoals, water surface	1,005
12.0	White oak tree, nail in root, at side of rock bluff, left bank	1,020.21
12.0	Water surface	1,009
	Robinsons Ford, water surface	1,012
13.0	Red-oak tree, nail in root, 10 feet from river at Robinsons ford	1,025.30
	Foot of small shoal, water surface	1,014
	Head of small shoal, water surface	1,016
14.2	Water surface	1,017
14.3	Red-oak tree, nail in root, 50 yards below mouth of Yellow Creek	1,048.27
14.3	Water surface	1,022
15.2	Pine tree, nail in root, opposite shoals	1,049.28
15.2	Foot of shoals, water surface	1,024
15.2	Top of shoals, water surface	1,027
17.4	Small pine tree, nail in root, 50 feet from river on east bank	1,062.63
17.4	Water surface	1,028
17.5	Foot of small dam, water surface	1,039
	Head of small dam, water surface	1,043
17.5	Iron bolt, top of center pier, west side of new bridge at New Bridge	1,060.43
	Foot of North Georgia Electric Company's dam, water surface	1,043
17.7	Top of North Georgia Electric Company's dam, water surface	1,070
19.8	Pine tree, nail in root, left bank	1,079.43
20.9	Head of shoal, water surface	1,070
21.5	Foot of shoal, water surface	1,075
21.6	Head of shoal, water surface	1,079
22.6	Brierpatch Bridge, top of iron bolt, south side of east approach	1,104.71
22.6	Brierpatch Bridge, water surface	1,082
23.5	Foot of small shoal	1,084
23.8	Red-oak tree, nail in root, near mouth of branch	1,106.49
23.8	Water surface	1,089
	Persimmon tree, nail in root	1,114.62
24.9	Foot of dam, water surface	1,092
	Top of old dam at stamping mill, water surface	1,104
27.1	Foot of shoals, water surface	1,106
	Iron bridge, water surface	1,109
27.3	Beech tree, nail in root, 60 feet below iron bridge	1,121.86
	Foot of Chestatee dam, water surface	1,115
27.5	Top of Chestatee dam, water surface	1,119
29.9	Foot of shoal, water surface	1,122
30.1	Top of shoal, water surface	1,125
30.7	Beardens Bridge, iron bolt, top of stone pier on west approach	1,150.10
30.7	Beardens Bridge, water surface	1,130
31.3	Three-fourths mile south of gorge dam, water surface	1,133
31.8	Foot of shoals below dam, water surface	1,138
31.9	Hickory tree, nail, 40 feet below the gorge dam	1,159.21
32.8	Foot of shoal, water surface	1,150
33.1	Top of shoal, water surface	1,155
33.7	White-oak tree, nail in root	1,166.95
33.7	Water surface	1,160
	Foot of shoal, water surface	1,163
34.2	Top of shoal, water surface	1,169
34.9	White-pine tree, nail in root, right bank of river	1,183.54
	Foot of shoals, water surface	1,174
35.1	Head of shoals, water surface	1,187
35.8	Foot of shoals, water surface	1,189
36.0	Head of shoals, water surface	1,200
36.1	Hickory tree, nail in root	1,214.34
36.1	Foot of shoals, water surface	1,201
36.3	Top of shoals, water surface	1,206
36.5	Foot of shoals, water surface	1,207

Elevations on Chestatee River from mouth to Willow—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
36.5	Large rock, right bank, 100 yards below ford, marked "X" with chisel	1,210.11
36.6	Grindle lower ford, water surface	1,216
	White-oak tree, on side of rock bluff, in fork between Chestatee and Tesnatee rivers.	1,231.2
37.0	Foot of shoals at mouth of Tesnatee River, water surface	1,215
37.4	Head of shoals, water surface	1,262
37.7	Large birch tree, nail in root, near ford	1,265.4
37.8	Foot of shoals at Grindle ford, water surface	1,283
38.3	Head of shoals, water surface	1,293
	Sweet-gum tree, nail, left bank, opposite foot of shoals	1,303.19
	Foot of shoals, water surface	1,296
38.9	Head of shoals, water surface	1,304
39.2	Foot of bridge at old gold stamp mill, water surface	1,305
39.5	Nail in red-oak tree, on left bank, 10 feet below Garnetts Bridge	1,318.3
39.5	Water surface	1,309
	Bottom of old dam, Garnetts dam, water surface	1,317
39.7	Top of old dam, Garnetts dam, water surface	1,321
40.4	Nail in root of spruce pine at mouth of small creek, opposite center of shoals	1,335.39
	Foot of shoals, water surface	1,328
40.8	Head of shoals, water surface	1,346
41.3	Nail in root of hickory, 60 feet below foot of shoals, left bank	1,364.2
41.3	Foot of shoals, water surface	1,353
41.7	Head of shoals, water surface	1,377
	Nail in root of large white-oak tree, left bank, opposite shoals	1,388.79
42.3	Foot of shoals, water surface	1,378
42.5	Head of shoals, water surface	1,384
	Foot of Crooked Shoals, water surface	1,386
42.8	Head of Crooked Shoals, water surface	1,390
43.0	Nail in root of red-oak tree, right bank, in sharp bend of river	1,404.55
43.0	Water surface	1,394
43.5	Foot of shoals	1,399
43.7	Nail in root of red-oak tree, on right bank, opposite shoals	1,425.41
43.7	Water surface	1,405
43.9	Foot of large shoals, water surface	1,406
44.0	Head of large shoals, water surface	1,415
44.7	Nail in root of red-oak tree, on right bank	1,437.94
44.7	Water surface	1,416
45.0	Foot of shoals, water surface	1,422
45.2	Head of shoals, water surface	1,428
	Foot of shoals, water surface	1,438
46.1	Head of shoals, water surface	1,443
46.7	Foot of shoals, water surface	1,444
46.7	Head of shoals, water surface	1,446
46.7	Nail in root of maple tree, west side of the river	1,447.54
47.4	Water surface	1,449
47.7	Nail in root of walnut tree, near west end of bridge	1,461.37
47.7	Water surface	1,454
47.7	Willow, Ga., 24 miles north, bronze tablet cemented in rock, on west side of river at fork of road, marked "1529 ATLANTA"	1,528.68

SURVEY OF FLINT RIVER.

In May, 1900, a survey was made of Flint River from the Geological Survey gaging station, about 3 miles east of Woodbury, Ga., on the Macon and Birmingham Railroad bridge over the river, to the line of the Creek Agency Reserve near Roberta and Knoxville, a distance of 45.4 miles downstream. The work was done by Mr. D. L. Wardroper, under the supervision of B. M. Hall, resident hydrographer. In this 45 miles the river cuts through Pine Mountain, the western coast range of the State, and descends with a total fall of 334 feet. The elevations are all above sea level, being taken from the track of the Atlanta and Columbus line of the Southern Railway, in front of the station at Woodbury, which is 780 feet above sea level. From this the zero of the Woodbury River gage was found to be 659.63 feet above sea level.

Elevations on Flint River from Woodbury to line of Creek Agency Reserve near Roberta.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0.0	Zero of gage at Woodbury Station, water surface	659.63
.0	Woodbury gaging station, water surface	661.0
.0	Bench mark No. 1, top of northwest corner of bearing stone under south truss at west end of M. and B. R. R. bridge	681.1
.6	One-fourth mile below mouth of Cane Creek, water surface	660.0
2.3	Two hundred feet above Meltons upper ford, water surface	641.8
2.5	Nine hundred feet below Meltons upper ford, water surface	637.2
5.0	Bench mark No. 2, nail in leaning catalpa tree at Miltons boat landing, on right bank of river	638.8
5.2	Five thousand feet below Brown Creek, water surface	633.9
7.1	Mouth of Pigeon Creek, water surface	620.8
7.1	Bench mark No. 3, nail in pine tree on left bank, 200 feet below mouth of Pigeon Creek	628.5
9.1	Six hundred feet above Passleys ford, water surface	596.6
9.8	Twelve hundred feet below Passleys Creek, water surface	596.9
12.1	Bench mark No. 4, nail in pine tree on left bank, 100 feet below mouth of Valley Creek	566.5
12.1	Mouth of Valley Creek, water surface	562.2
13.2	Double-bridge ford 800 feet above Womble Creek, water surface	552.8
15.5	End of line between districts Nos. 1 and 23, water surface	522.0
15.5	Bench mark No. 5, white oak on top of slope on left bank, 100 feet below field, opposite line between districts Nos. 1 and 3	531.8
15.8	Bench mark No. 6, sweet-gum tree in field 50 feet below Talbotton and Thomaston road, about 150 feet from river	516.7
17.3	Eight hundred feet below mouth of Earls Creek, water surface	512.0
17.6	Talbotton and Thomaston road, water surface	507.3
18.5	Top of Yellow Jacket Shoals, 450 feet below Talbotton and Thomaston road, water surface	499.6
20.3	Nine hundred feet above mouth of Lazer Creek, water surface	427.0
23.4	Water surface	416.6
23.5	Water surface	411.9
24.6	Bench mark No. 7, top of west end of wooden cap on north masonry abutment of wagon bridge at Flat Shoals road	431.6
25.0	Twenty-three hundred feet below new bridge at Flat Shoals road, water surface	409.3
26.3	Twenty-nine hundred feet above mouth of Big Potato Creek, water surface	402.5
26.8	Bench mark No. 8, nail in water oak on right bank of Big Potato Creek, 200 feet above mouth	413.6
26.9	Bench mark No. 9, nail in root of sweet-gum tree south of road at Parkers Ferry	417.7
27.5	Thirty-five hundred feet below mouth of Big Potato Creek, water surface	400.5
27.6	Thirty-nine hundred feet below mouth of Big Potato Creek, water surface	398.9
28.7	One hundred feet below Hatchasofkee Creek, water surface	396.6
30.0	Nineteen hundred feet above Elliotts Ferry, water surface	374.0
32.3	Six hundred feet above Walkers Ferry, water surface	359.4
37.5	Eight hundred and eighty feet below Ducks Creek, water surface	349.3
	Bench mark No. 10, nail in leaning ash tree on right bank of Swift Creek, 3,000 feet from its mouth ,100 feet from north end of bridge	377.1
	Bench mark No. 11, nail in root of beech tree at south end of bridge mentioned in description of bench mark No. 10	379.7
41.1	Fifty-five hundred feet above Grays Ferry, water surface	345.9
42.4	Bench mark No. 12, nail in root of sweet gum opposite boat landing at Grays Ferry, left bank	353.1
43.9	Twenty-nine hundred feet below mouth of Auchumkee Creek, water surface	339.7
44.0	Water surface	335.2
44.7	Water surface	334.9
45.0	Eighty-nine hundred feet below mouth of Auchumkee Creek, water surface	328.8
45.5	Water surface	327.0
46.9	Bench mark No. 13, tin cap on root of red oak 20 feet west of north of the north-south line on west boundary of lot No. 176, fourteenth district, of Taylor County	352.9

WATER POWER IN APALACHICOLA RIVER DRAINAGE BASIN.

CHATTAHOOCHEE RIVER.

In the foregoing lists of water-surface elevations several surveys have been put together, so as to give a continuous chain of elevations, and, for the main river, the distance of each point noted is given in miles above Columbus. Objects along the river are also noted and serve to locate and make it possible to identify each point at which the surface elevation is given.

The fall at any point or between any points can therefore be determined, and the amount of water flowing at it can be estimated from the records of the hydrographic stations at West Point, Oakdale, Norcross, Buford, and Gainesville, and from miscellaneous measurements.

At Columbus is the fall line, and immediately above are located the largest falls on the river. Here a large amount of water power has been in use for many years.

The developed water powers are: (1) Eagle and Phoenix dam, operating the Eagle and Phoenix, and Muscogee mills; fall 26 feet. (2) City Mills dam; fall 9 feet. (3) Columbus Power Company's dam and tailrace; fall 40 feet. The last mentioned was completed in 1902. The stone dam is located above the foot of the shoals, a considerable portion of the head being obtained by excavating for the tail-water. Water is backed three-fourths mile above the dam, and reaches the foot of a very fine shoal, the Chattahoochee Falls Company's property, where there is a fall of 40 feet in little more than 1 mile. The old Clapp factory was located on this property and the power was supplied by a wing dam, about half of the fall being used. The present owners of the property have secured water rights along the river above, which will enable them to develop a much higher head and will also give a larger storage. The fall from the upper line of the original property to foot of shoals on Ogletree's land is 21 feet in 7 miles. From this point up to the lower end of Hargetts Island, 10 miles above, the fall is 150 feet.

Along this portion of the river the banks are high and rocky. The river is mostly wide and full of islands, but at several places the banks come close together, affording excellent sites for high dams, in some cases not more than 600 feet long.

In the 7 miles from Hargetts Island to the foot of Riverview dam the fall is 42 feet. At the Riverview mills and Langdale mills there are developed powers, each using 10 or 12 feet of fall.

Above the Langdale mills up to West Point the amount of fall is small. Between West Point and Franklin the fall is 75 feet in 38 miles, averaging about 2 feet a mile. The fall is not uniformly distributed, however, and it is probable that some really good power developments could be made.

At Franklin, where there is an excellent site for a dam, extensive surveys have been made for one 32 feet high, which would back water 8½ miles, to the head of Fishtrap Shoals. This proposed development includes Bushyhead Shoals and several others not so large.

From here to the foot of McIntosh Shoals the fall is only 11 feet in 11 miles. At McIntosh Shoals there is a fall of 8 feet in one-half mile.

Above this shoal up to the mouth of Peachtree Creek, above Atlanta, the fall is 66 feet in 47 miles. Three miles above is the dam

site of a proposed development of 32 feet, for which complete surveys have been made.

At Bull Sluice, 4 miles below Roswell, is the new electric power plant of the Atlanta Water Power and Electric Company. The dam is a massive concrete structure, 48 feet high, which with the 2-foot flashboards, gives a head of 50 feet. This plant is fully equipped with the most modern type of water wheels and electric generators. The combined capacity of the water wheels is greatly in excess of the normal low-water flow of the river, thus providing for a large increase of power from stored water, and at times when the flow of the river is increased. The power is all transmitted electrically to Atlanta. Backwater from this dam, when flashboards are used, reaches a point just under the wagon bridge at Roswell.

In the 26 miles above Roswell, reaching to Bowmans Island, near Buford, there is a fall of about 57 feet, the drop being as much as 5 or 6 feet to the mile in a few places. At Bowmans Island is a proposed site for a 50-foot dam to back water 14 miles up to mouth of Chestatee River.

From the mouth of Chestatee River, up to the mouth of Little River, there are a number of small shoals aggregating 28 feet of fall. Beginning a short distance above Little River is a series of shoals, which has recently been developed by the North Georgia Electric Company. The dam of this plant is located a quarter of a mile above the foot of the shoals, leaving about 7 feet of the fall undeveloped. It is a log crib structure entirely filled with rock and is 36 feet high. The power is transmitted electrically from the plant. Backwater extends 8 miles, to above Clarks Bridge. In the next 11 miles, up to Belton, the fall is about 30 feet and includes several shoals and some good sites for dams.

In the next 9 miles, extending to mouth of Soque River, the fall is 81 feet, including Harrisons Shoals, Perkins Shoals, and a series of shoals above and below Duncans Bridge, the latter series having a fall of 20 feet in 1¼ miles.

Above the mouth of the Soque River is a series of shoals, with a total fall of 106 feet in 4¼ miles. Along this part of the river the banks are steep and rocky, and there are numerous good dam sites.

WATER POWERS ON SOQUE RIVER.

In 5½ miles above the mouth of the river the fall is 30 feet, including several small shoals. One mile downstream from Porter Mills there is an undeveloped fall of 6 feet in about 50 yards, with 7 feet of fall above, to the foot of Porter Shoals. At Porter Mills is the Porter Shoals, an almost vertical drop of 48 feet and by far the best waterfall on the river. This is partly developed by a small wing dam, the

power being used to operate Porter's woolen and cotton factory, 4 miles from Demorest, the nearest railroad point.

About 500 feet upstream is Porters Upper Shoal, with a 15-foot fall, also partly developed by a small dam, and supplying power for factory No. 2 of the same company. A much greater head could be obtained here by increasing the height of the dam. One and one-half miles above Porter Mills is a good water-power site, known as the Old Factory Shoals, where there is a fall of 23 feet in a distance of 600 feet. This was utilized at one time, but all signs of the dam have vanished.

WATER POWERS ON CHESTATEE RIVER.

From the mouth of the river up to the foot of the North Georgia Electric Company's dam, at Newbridge, a distance of 17½ miles, the fall is 83 feet. This includes three small dams and a number of undeveloped shoals, but no especially favorable sites for large powers.

The North Georgia Electric Company's dam is 27 feet high, and is made of log cribs filled with rock, and backs water about 3½ miles. Above this dam there is a large amount of fall and many good power sites, some of which are developed and used to operate machinery connected with gold mining. Most of the undeveloped powers are owned or controlled by various mining companies.

WATER POWERS ON FLINT RIVER.

The country rock in the Flint River basin over the range of the preceding elevations is vitrified sandstone or quartzite, forming fine bluffs and occasional narrow gorges suitable for dam sites. It is easily quarried, and comes out in square blocks that are excellent for building dams.

The first shoals, known as the Dripping Rock Shoals, begin near the mouth of Cane Creek, about 3,000 feet below the bridge, and fall 23.7 feet in about 2 miles. In the next 2 miles, or to a point about 1 mile below the mouth of Pigeon Creek, the river falls only 6 feet. Then shoals begin which have a practically uniform fall of 10.5 feet per mile for a distance of 8½ miles, or to Double Bridges (Gibson's old ferry), the total fall in that distance being 90 feet. From that point to the north boundary of the twenty-third land district the fall is 20 feet in a distance of 4,700 feet. In the next 3 miles, or to the head of the Yellow Jacket Shoals, there is a total fall of 22 feet.

The Yellow Jacket Shoals are the finest on the river. They are below Pigeon Creek and above Lazer Creek (sometimes called Eliza Creek), near Rowland, in Upson County, about midway between Talbotton and Thomaston, in the heart of the cotton belt of Georgia. They have a fall of 65 feet in a distance of 7,900 feet, or 1½ miles, al

of which can be utilized. In fact a much larger head would be available by building a 42-foot dam at the head of the Yellow Jacket Shoals and taking the water in a canal to a point opposite the foot of the shoals. This would cover a fall of 107 feet, 7 feet of which would be sufficient for storage and canal grades, leaving a net working head of 100 feet. A dam of this height would back the water about 4 miles. There would be no trouble from flood water on the wheels, for the river is very precipitous below the foot of the Yellow Jacket Shoals, having an average fall of 6 feet to the mile in the next 10 miles, the most precipitous part being a fall of about 25 feet between Hatchasofkee Creek and Elliotts Ferry, a distance of about 2 miles. Elliotts Ferry is between the mouths of Mountain Creek and Deep Gulch Creek.

Below Elliotts Ferry the river falls 13 feet in the next 2 miles, or to Walkers Ferry, and then assumes a practically uniform grade of 1.7 feet to the mile for the next 11 miles, or to a point one-half mile below the mouth of Auchumkee Creek, in Crawford County, which is at the head of small shoals having a fall of 10 feet in a distance of 1 mile. This is practically the point where the river crosses the fall line and enters the younger geologic formations. The survey ended here.

Along the portion of the river surveyed there are several large tributaries which have fine shoals. The most notable of these is Big Potato Creek, near Thomaston, in Upson County, which has three shoals near its mouth, surveyed in 1891 by C. C. Anderson, assistant State geologist, and reported by him to be as follows: Rogers Shoals, 31 feet fall in a distance of 3,500 feet; Nelson Shoals, 115 feet fall in a distance of 2,700 feet, and Daniels Shoals, 13 feet fall in a distance of 150 feet.

About 10 miles above Woodbury there is a fine water power on Flint River, 1 mile from Neal, on the Southern Railway. It is known as the Flat Shoals and has a fall of 32 feet in a distance of 3,000 feet. There is a natural storage basin just above these shoals, where it is estimated that a 2-foot dam would store the low-water flow of the river for twelve hours, and that a 4-foot dam would store it for thirty-eight hours. This power is not included in the survey described, but was surveyed separately by B. M. Hall. It can be developed by a canal 3,000 feet long, or by a dam at the foot of the shoals, where there is a narrow shut-in.

MOBILE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The drainage basin of the Mobile River is the largest in Georgi Alabama, and is designated the Mobile basin because its wate enter the Gulf through Mobile River at Mobile, Ala. At its waters, Cartecay and Ellijay rivers unite at Ellijay to form Coos tee River, which, just above Resaca, unites with the Conasau form Oostanaula River. At Rome, Ga., the Oostanaula an Etowah unite to form Coosa River. Six miles above Montgo Ala., the Coosa and the Tallapoosa unite to form Alabama Rive not far from the coast the Tombigbee unites with the Alabama to Mobile River, which flows into Mobile Bay, an arm of the G Mexico.

Cahaba River is the principal tributary of the Alabama and j about 10 miles below Selma. Hillabee Creek flows into Talla River just above Sturdevant and near Alexander. Talladega is a tributary of the Coosa.

Tombigbee River rises in the northeastern part of Mississipp enters Alabama in Pickens County. Its principal tributary i Black Warrior, which is formed by the junction of Mulberry For Sipsey Fork. Locust Fork enters the Black Warrior some dis below the junction.

This paper discusses only the gaging stations in the Mobile dra basin which are located in the State of Georgia. For stations lo in Alabama and Mississippi the reader is referred to Water-S Paper No. 107, Water Powers of Alabama and Mississippi, and t Reports of Progress of Stream Measurements, published b United States Geological Survey.

STREAM FLOW.

ETOWAH RIVER NEAR BALLGROUND.

This station was established in 1905. It is located at an iron way bridge about 2½ miles south of Ballground, and half a mile b the mouth of Long Swamp Creek.

The channel is nearly straight for 300 feet above and 600 feet b the station, and the current is moderately swift and fairly goo measurement. The left bank is high and will not overflow, but right bank is low and cultivated for about 500 feet and will ove at a gage height of about 16 feet above low water. The bed of river is partly rock.

Discharge measurements are made from the bridge of two iron sp The left span is 110 feet long, and spans the entire river excep

floods. The other span, which is over low ground on the right bank, is 100 feet long, and there is also 90 feet of wooded trestle on the right bank. Gage heights are determined directly from the bench mark, which is the top of the upstream end of the first floor beam to the left of the middle pier; elevation, 28.00 feet above the datum of the assumed gage.

Discharge measurements of Etowah River near Ballground.

Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*
June 24	3.10	763
November 15	2.24	408

ETOWAH RIVER AT CANTON.

This station was established in 1892 by the United States Weather Bureau, and it was only in 1896 that measurements were begun by the United States Geological Survey. It is located at the wagon bridge in Canton, one-half mile above the mouth of Canton Creek and 1,000 feet upstream from the Atlanta, Knoxville and Northern Railway station.

The channel is straight for 1,000 feet above and 500 feet below the bridge. The current is affected by a fish-trap dam about 1 foot high, which has caused much trouble by being occasionally washed away and built up again. Up to gage height 3 feet the river is only 116 feet wide and flows between the piers on its lower banks. Up to about 14 feet it is confined between its upper banks, which are the abutments at the outer ends of the approaches, but above 14 feet it begins to overflow the bottom lands. The bed is fairly constant.

Discharge measurements are made from the upstream side of the iron highway bridge. The initial point for soundings is the river side of the right-bank pier at the end of the main span. The gage is a heavy vertical timber, fastened to the edge of the left-bank pier, on the upstream side. The gage is read once each day by J. M. McAfee, who is paid by the United States Weather Bureau for six months of the year and by the Georgia Geological Survey for the other six months. Bench marks were established as follows: (1) A cut on a silver-maple tree on the east side of the road, 20 feet from the end of the bridge, on the south or left bank of the river; elevation, 20.36 feet. (2) The top of the iron bar on the top of the left-bank pier at the end of the center span of the bridge, upstream side; elevation, 23.39 feet. Elevations refer to the datum of the gage.

Discharge measurements of Etowah River at Canton.

Date.	Gage height.	Discharge.
1896.	*Feet.*	*Sec.-ft.*
April 29	0.05	590
July 7	.59	862
September 9	− .65	218
October 28	.45	733
October 28	2.25	2,327
November 27	− .05	449
1897.		
March 17	2.60	2,656
May 5	.75	1,264
June 16	1.27	1,632
August 28	− .30	449
September 21	− .60	284
November 12	.23	346
December 13	.33	514
1898.		
January 13	.60	761
March 5	.33	621
March 19	5.60	5,124
May 20	.60	627
June 4	.22	495
July 19	.25	413
August 30	.65	1,062
September 6	3.25	3,190
September 7	2.00	2,104
November 18	.90	1,223
December 10	.70	1,064
1899.		
April 27	1.92	2,087
June 23	.25	770
September 27	− .19	406
November 10	− .10	420
1900.		
February 27	.80	1,113
May 19	1.05	1,351
December 1	.55	816
1901.		
February 5	2.85	2,578
April 25	1.50	1,
August 16	2.85	2,
November 2	.25	
1902.		
March 29	15.10	12
April 26	.90	1
July 12	.51	
August 16	.20	
November 22	.44	
1903.		
January 28	1.07	
March 27	2.50	2
April 27	1.80	1
June 25	.94	1
June 25	.93	1
September 4	.51	
September 4	.51	
October 10	.60	
1904.		
January 15	.50	
March 3	.78	
May 17	.18	
July 26	.04	
July 26	.04	
September 1	.09	
October 8	− .38	
October 8	− .25	
October 13	− .38	
1905.		
January 21	.67	
January 21	.67	
January 21	.67	
April 20	.61	
June 3	.49	
October 18	.14	
October 18	.14	
November 17	.14	
November 17	.14	

Daily gage height, in feet, of Etowah River at Canton.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1896.												
1	0.6	1.8	0.6							0.0	0.0	
2	.6	1.8	.5							− .2	− .1	
3	.6	1.8	.5							− .3	− .1	
4	.6	1.8	.5							− .3	.0	
5	.6	1.8	.5							− .4	+2.8	
6	.6	2.0	.5							− .4	.8	
7	.5	3.0	.8							− .5	.6	
8	.7	3.0	.8							− .5	.6	
9	.7	3.5	.8						−0.65	− .5	.4	
10	.7	2.0	.8						− .6	− .3	.4	
11	.7	1.8	.8						− .6	− .3	.4	
12	.7	1.8	.8						− .65	− .4	.0	
13	.7	1.8	.8						− .7	− .2	3.6	
14	.7	1.0	.8						− .75	− .3	1.0	
15	.7	1.0	.7						− .6	− .4	.7	
16	.7	1.0	.8						− .55	− .4	.7	
17	1.0	1.0	.8						− .65	− .4	.4	
18	.8	1.0	.7						− .75	− .4	.2	
19	.8	1.0	1.0						− .75	− .4	.0	
20	.8	1.0	1.0						− .75	− .5	.0	
21	.8	1.0	1.0						− .75	− .5	.0	
22	1.0	.8	.8						− .6	− .5	.0	
23	3.8	.8	.8						− .1	− .5	.0	
24	5.8	.8	.8						− .3	.0	.0	
25	3.0	.8	.6						− .4	− .1	.0	

Daily gage height, in feet, of Etowah River at Canton—Continued.

y.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
5.												
.....	2.0	0.6	0.6	.....	.....	.....	.....	.....	− 0.6	−0.1	0.0	0.0
.....	2.0	.6	.6	.....	.....	.....	.....	.....	− .6	− .1	.0	.0
.....	2.0	.6	.6	.....	.....	.....	.....	.....	− .6	+2.25	.0	− .1
.....	1.8	.6	.6	.....	.....	.....	.....	.....	− .6	1.1	.0	− .1
.....	1.8	.....	.6	.....	.....	.....	.....	.....	+ .7	1.0	1.0	− .1
.....	1.8	.....	a1.0	.....	.....	.....	.....	.....	.....	.0	1.4	− .1
7.												
.....	− .1	.6	.8	1.6	2.0	.1	.0	.2	.8	− .7	.2	.6
.....	− .1	2.2	.6	2.0	1.8	.1	.0	.0	.0	− .7	.8	.6
.....	− .1	1.0	.6	2.0	1.8	.7	.0	.0	− .3	− .7	.8	.6
.....	− .1	.8	.6	2.6	1.6	.5	.0	.0	− .4	− .5	.6	.6
.....	− .1	.8	.6	11.2	.7	.5	.0	.0	− .4	− .4	.5	2.0
.....	− .1	.9	3.6	5.0	.7	.5	.0	.6	− .5	− .3	.5	1.0
.....	− .1	.8	4.0	3.0	.7	.4	.4	.8	− .5	− .3	.3	.9
.....	− .1	.8	2.0	2.0	.6	.4	.4	.8	− .5	− .4	.3	.8
.....	− .1	.8	1.8	3.0	.6	.3	.4	.6	− .6	− .4	.3	.8
.....	− .1	.8	1.8	2.6	.5	.3	.3	.6	− .6	− .4	.2	.8
.....	− .1	.8	1.8	2.4	.5	.2	.3	.6	− .6	+1.2	.2	.8
.....	− .1	.8	2.8	2.2	.5	.1	.2	.4	− .6	1.0	.2	.6
.....	− .1	1.8	7.2	2.0	.5	.1	.2	.4	− .6	.8	.2	.8
.....	2.2	1.0	6.8	2.0	.4	.1	.2	.2	− .6	.8	.2	.9
.....	1.8	.8	4.0	2.0	.4	.0	.1	.2	− .6	.6	.2	.9
.....	.9	.8	3.6	1.8	.4	3.0	.1	.2	− .6	.6	.2	.8
.....	.5	.7	2.6	1.8	.4	1.0	.9	1.0	− .6	.6	.2	.7
.....	2.0	.6	2.4	1.4	.4	.8	.9	1.0	− .6	.4	.2	.7
.....	1.6	.6	2.0	1.4	.4	.6	1.0	.8	− .6	.4	.1	.8
.....	3.6	.6	2.8	1.2	.4	.4	2.0	.6	− .6	.6	.1	.8
.....	3.0	.8	2.0	1.2	.3	.4	7.1	.4	− .6	.4	.2	.9
.....	2.0	.8	1.0	1.0	.3	.3	2.5	.2	− .6	.4	.2	1.0
.....	1.0	1.6	1.8	1.0	.2	.3	1.0	.0	− .5	.4	.2	.9
.....	.8	1.0	1.8	1.0	.1	.3	.8	.0	− .5	.4	.2	.8
.....	.7	1.0	1.6	1.0	.1	.3	.8	.0	− .5	.4	.8	.8
.....	.7	.8	1.6	.8	.1	.2	.6	− .1	− .8	.4	.6	.8
.....	.7	.8	1.4	.8	.1	.1	.6	− .2	− .6	.3	.6	.7
.....	.6	.8	1.2	.8	.1	.1	.5	− .3	− .5	.3	.6	.6
.....	.6	.....	1.2	1.0	.1	.1	.5	− .4	− .6	.3	.8	.6
.....	.6	.....	1.2	1.0	.1	.1	.4	− .4	− .6	.3	.6	.6
.....	.6	.....	1.2	.....	.1	.....	.2	+1.0	.....	.2	.....	.5
8.												
.....	.5	.8	.3	1.6	.6	.6	.3	.4	.4	.4	.8	1.6
.....	.5	.8	.3	1.4	.6	.4	.2	.4	11.5	.4	.8	1.6
.....	.3	.8	.6	1.2	.6	.3	.2	2.0	9.0	.3	.7	1.6
.....	.3	.7	.6	1.0	.5	.2	.2	3.4	4.0	9.0	.7	2.0
.....	.2	.6	.4	2.0	.5	.2	.4	3.0	2.0	13.5	.7	2.4
.....	.2	.6	.4	3.6	.4	.2	.4	2.0	3.0	4.0	.8	2.4
.....	.3	.6	.4	3.0	.4	.2	.8	3.0	2.4	2.4	.7	2.2
.....	.3	.6	.3	1.8	.4	.2	1.8	3.0	1.6	2.0	.6	2.2
.....	.3	.5	.2	1.0	.4	.2	.8	2.0	1.4	1.6	.6	2.1
.....	.4	.5	.2	.8	.4	.1	.8	4.0	1.4	1.4	.7	2.0
.....	.6	.4	.2	.8	.3	.1	.9	6.0	1.6	1.2	.8	2.0
.....	.8	.4	.2	.6	.3	.1	2.9	4.0	1.4	1.2	.7	1.8
.....	.8	.4	.2	.6	.3	.1	2.0	3.5	1.4	1.1	.7	1.8
.....	.6	.4	.1	.6	.3	.7	1.8	2.0	1.0	1.1	.6	1.8
.....	.6	.4	.4	.5	.3	.6	1.6	1.8	1.0	1.0	.8	1.7
.....	.8	.4	4.0	.5	.3	.6	1.4	1.6	1.0	1.0	.8	1.7
.....	.8	.4	3.0	.4	.3	.5	1.2	1.4	.8	1.0	.8	1.7
.....	.8	.3	.8	.4	.2	.5	.6	1.2	.8	4.2	.9	1.6
.....	.9	.3	.6	.8	.2	.4	.2	1.0	.6	3.0	1.0	1.6
.....	.9	.4	.6	.6	.2	.4	.2	.8	.6	2.0	1.2	1.6
.....	.8	.5	.4	.7	.2	.4	.2	.6	.4	2.0	1.2	1.6
.....	.8	.4	.4	.6	.2	.4	.3	.4	.4	2.0	1.6	1.5
.....	.9	.4	.4	.8	.8	.3	.3	.4	.4	1.8	2.0	1.4
.....	.9	.4	.3	2.0	.8	.3	7.3	.4	.8	1.6	1.8	1.4
.....	2.0	.3	.2	.9	.6	.3	2.0	.4	.6	1.4	1.6	1.4

her Bureau discontinued observations March 31, 1896; Geological Survey began observations er 9, 1896.

Daily gage height, in feet, of Etowah River at Canton—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	D
1898.												
26	5.6	0.3	0.2	0.8	0.6	0.3	2.0	0.4	0.6	1.2	1.6	
27	4.0	.3	.1	.8	.5	.3	1.8	3.6	.4	1.0	1.5	
28	2.6	.3	.2	.8	.4	.3	1.8	2.4	.4	1.0	1.5	
29	1.3	.....	5.0	.6	.4	.3	1.8	1.8	.4	.9	2.0	
30	1.0	.....	4.0	.6	.4	.3	1.8	1.0	.4	.8	1.8	
31	.9	.....	3.0	.....	.8	.....	1.8	.6	.....	.8	.....	
1899.												
1	1.8	1.6	3.0	2.4	1.6	1.0	1.4	1.4	.8	— .4	— .1	
2	1.8	1.6	2.8	2.2	1.5	1.4	1.4	1.4	.6	— .4	— .1	
3	1.8	1.8	2.8	2.0	1.4	1.4	1.4	1.8	.6	— .5	— .1	
4	1.8	2.8	2.6	3.8	1.4	4.4	1.2	1.6	.6	— .5	— .1	
5	1.8	3.0	2.4	3.0	1.4	3.0	1.2	1.6	.6	— .5	— .1	
6	1.8	0.2	2.0	2.8	1.4	1.0	1.0	1.4	.6	.0	— .1	
7	1.6	8.0	1.8	2.8	1.4	1.0	1.4	1.2	.5	.2	— .1	
8	1.4	4.0	1.8	4.0	1.4	1.0	1.6	1.6	.5	.2	— .1	
9	1.4	3.2	1.6	3.0	1.6	1.0	4.0	1.8	.4	.2	— .1	
10	1.4	3.0	1.5	2.8	1.6	1.0	2.0	1.6	.4	.1	— .1	
11	1.4	2.0	1.5	2.0	1.4	1.4	1.8	1.6	.4	.1	— .1	
12	1.8	(a)	1.4	1.8	1.4	1.6	1.6	1.6	.4	.1	— .1	
13	1.8	(a)	1.4	1.8	1.4	1.6	1.4	1.4	.4	.0	— .1	
14	2.8	(a)	3.6	1.8	1.8	1.4	1.4	1.2	.4	.0	— .1	
15	2.6	3.0	7.0	1.8	1.8	1.4	1.8	1.2	.4	.0	.0	
16	2.4	2.0	18.2	1.6	1.8	1.4	1.9	1.0	.4	.0	.0	
17	2.3	2.0	18.0	1.6	1.6	1.4	1.8	1.0	.3	.0	.1	
18	2.3	2.0	4.0	1.6	1.6	1.4	1.8	.8	.3	.0	.0	
19	2.2	2.0	4.0	1.4	1.6	1.4	1.8	.8	.3	.0	.0	
20	2.2	1.8	3.0	1.4	1.4	1.3	1.6	1.4	.2	— .1	.0	
21	2.0	1.8	2.0	1.4	1.4	1.3	1.6	1.4	.1	— .1	.0	
22	1.8	1.8	2.0	1.4	1.4	1.3	1.6	1.2	.0	— .1	.0	
23	1.8	1.8	2.0	1.4	1.4	1.2	1.6	1.0	.0	— .1	.9	
24	2.0	1.6	1.8	1.8	1.4	1.2	1.4	1.0	.0	— .1	.7	
25	2.8	1.4	1.8	4.8	1.4	1.2	1.2	.8	— .1	— .1	.7	
26	2.0	1.8	2.8	3.0	1.2	1.0	1.2	.8	— .1	— .1	1.1	
27	1.8	10.0	2.0	2.8	1.2	1.0	1.2	1.4	— .1	.0	.7	
28	1.8	5.0	1.8	2.0	1.2	1.0	1.2	1.2	— .2	.0	.5	
29	1.8	.....	2.8	1.8	1.2	1.0	1.2	1.0	— .3	— .1	.1	
30	10.0	.....	2.0	.....	1.2	1.0	1.1	1.0	— .3	— .1	.1	
31	5.0	.....	2.6	.....	1.0	.....	1.0	.8	.....	— .1	.....	
1900.												
1	.6	.6	.8	1.4	1.2	1.4	1.7	1.0	.6	.3	1.3	
2	.6	.8	.8	1.0	1.2	1.4	1.7	1.0	.6	.2	1.4	
3	.6	1.0	.8	.8	1.2	2.4	1.8	1.0	.6	.2	1.6	
4	.6	1.0	.8	.8	1.2	2.0	1.8	1.0	.6	1.6	1.6	
5	.6	1.2	.8	.8	1.1	3.0	1.8	1.0	.6	1.5	1.4	
6	.6	1.2	.8	.8	1.1	3.0	2.4	.8	.6	1.3	1.4	
7	.6	1.2	.8	.8	1.1	6.0	2.2	.8	.6	1.3	1.4	
8	.6	2.7	3.4	.8	1.1	6.0	1.8	.8	.6	2.2	1.4	
9	.6	2.5	5.4	.8	1.1	4.0	1.3	.8	.6	3.1	1.4	
10	.6	1.8	2.2	.8	1.0	.....	1.2	.6	.6	2.0	1.4	
11	.6	2.7	1.6	.8	1.0	.....	1.0	.6	.6	2.0	1.4	
12	1.6	14.2	1.0	2.3	1.0	.....	1.0	.6	.6	2.0	1.4	
13	1.0	6.0	.9	2.6	1.0	.....	1.0	.6	.6	2.6	1.4	
14	.6	3.1	.8	2.2	1.0	.....	3.0	.6	.6	2.3	1.4	
15	.6	2.0	.8	2.0	.9	.....	1.8	.6	3.6	2.0	1.2	
16	.4	1.5	.9	1.8	.9	.....	1.2	.8	5.0	1.5	1.2	
17	.4	1.5	.9	1.8	.9	.....	1.2	1.7	3.1	1.4	1.2	
18	.4	1.0	.9	2.3	.9	.....	1.2	2.3	2.3	1.3	1.2	
19	1.0	1.0	.9	3.6	1.2	.....	1.0	2.3	1.6	1.0	1.4	
20	1.0	1.0	5.2	2.0	1.1	.....	1.0	2.0	1.4	1.0	2.1	
21	.4	1.0	3.6	5.0	1.0	.....	1.0	1.0	.8	1.0	4.6	
22	.4	1.0	1.8	3.0	1.0	.....	1.0	1.0	.7	1.0	2.7	
23	.4	1.0	1.8	2.0	1.0	.....	1.0	1.0	.6	2.0	3.0	
24	.4	1.0	2.8	4.0	1.8	.....	1.0	3.0	.6	7.2	2.1	
25	.4	1.0	2.1	2.0	1.4	.....	1.0	2.0	.6	3.5	2.0	
26	.4	1.0	3.6	1.8	1.2	.....	1.0	1.0	.6	2.7	4.0	
27	.4	.8	2.0	1.6	1.2	.....	1.5	.6	.6	2.5	2.2	
28	.4	.8	2.0	1.0	1.0	.....	2.8	.6	.4	2.0	2.0	
29	.4	.....	2.0	1.0	1.0	.....	3.5	.6	.4	1.8	1.0	
30	.4	.....	1.9	1.4	1.0	.....	4.0	.6	.3	1.4	.7	
31	.6	.....	1.9	.....	1.0	.....	2.0	.6	.....	1.3	.....	

a Gage covered with ice February 12 to 14, 1899.

Daily gage height, in feet, of Etowah River at Canton—Continued.

ay.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
01.												
.....	2.1	1.2	0.8	1.8	1.0	4.6	1.7	0.6	2.4	0.7	0.5	0.6
.....	1.8	1.0	.8	3.6	.9	2.4	1.2	.6	2.3	.8	.5	.8
.....	1.3	1.3	.7	4.8	.9	2.0	1.0	.5	2.2	2.9	.5	.8
.....	.9	6.0	.7	3.4	.8	3.6	.8	.5	2.0	2.8	.5	.9
.....	.7	4.1	.7	2.5	.8	3.0	.7	.5	1.8	2.0	.6	.9
.....	.7	2.0	.6	2.3	.8	2.8	.7	.4	1.7	1.0	.6	.9
.....	.7	2.0	.6	2.0	.9	3.4	2.6	1.1	1.5	.9	.6	.9
.....	.6	1.8	.6	1.9	.9	1.3	1.8	.7	1.3	.8	.6	.9
.....	.6	4.0	.6	1.3	.9	1.2	1.0	.6	1.1	.6	.6	.9
.....	.6	3.1	.8	1.0	.9	1.2	.9	.5	1.0	.6	.6	1.2
.....	6.4	3.0	.9	.9	.9	1.0	.8	.8	.9	.6	.7	1.1
.....	14.0	2.6	.8	.8	.9	.8	.7	1.9	.9	.6	.7	1.1
.....	4.5	2.3	.9	1.7	.8	1.4	.7	1.4	.8	.6	.7	1.1
.....	2.1	2.1	.9	3.0	.8	2.35	.6	1.2	.8	.5	.7	1.2
.....	1.8	1.8	.9	2.5	.9	5.3	.6	1.5	.7	.5	.7	4.0
.....	1.4	1.8	.8	2.0	.9	4.65	.6	2.5	.7	.5	.6	3.4
.....	1.1	1.8	.8	1.7	.8	3.2	.8	3.2	1.5	.5	.6	3.0
.....	1.0	1.8	.7	1.3	.8	3.1	1.7	2.8	2.8	.4	.6	2.0
.....	1.0	1.8	.7	4.0	.8	2.8	1.9	5.0	1.4	.4	.7	1.7
.....	1.0	1.6	.7	4.2	2.7	1.7	1.6	3.2	1.0	.4	.7	1.5
.....	.8	1.5	.6	3.8	12.2	1.5	1.1	5.2	.9	.3	.7	1.3
.....	.8	1.3	.6	2.6	16.6	1.3	1.0	7.0	.8	.3	.7	1.2
.....	.7	1.2	.6	2.4	5.7	1.2	.8	13.0	.7	.3	.8	1.2
.....	.9	1.0	.8	1.8	3.1	1.1	.7	3.2	.7	.2	1.0	1.1
.....	.9	.9	.8	1.6	2.8	1.0	.6	2.5	.6	.2	1.0	1.2
.....	.9	.9	17.0	1.5	2.4	.9	.5	2.3	.6	.2	.9	1.2
.....	1.0	.8	6.8	1.4	2.0	3.6	.9	2.1	.6	.2	.8	2.4
.....	1.3	.8	3.4	1.3	1.8	3.9	.8	3.9	.7	.2	.7	3.6
.....	1.2	.....	3.0	1.2	1.6	2.3	.7	2.7	.8	.2	.7	20.0
.....	1.0	.....	2.0	1.1	1.4	2.1	.7	2.5	.7	.1	.7	17.0
.....	1.3	.....	1.8	.....	2.4	.....	.7	2.4	.....	.1	.....	4.0
02.												
.....	3.7	5.6	10.8	2.8	.5	.4	.4	.5	.8	2.8	.6	2.7
.....	3.3	11.8	4.3	2.4	1.0	.6	.4	.5	.8	1.8	.5	4.0
.....	3.0	5.4	3.1	2.1	1.1	.6	.3	.5	1.2	.8	.5	4.2
.....	2.9	3.1	3.0	1.8	1.0	.3	.4	.5	1.2	.8	.5	2.1
.....	2.8	2.7	2.8	1.6	.9	.3	.4	.4	1.4	.8	.5	2.8
.....	2.5	2.3	2.8	1.5	.8	.3	.4	.4	1.4	.6	.8	1.8
.....	2.2	2.2	2.5	1.4	.7	.3	.4	.4	1.0	.6	.7	1.2
.....	2.0	2.1	2.1	1.4	.7	1.3	.4	.4	1.0	.6	.7	1.1
.....	1.9	2.0	1.9	1.3	.6	2.0	.4	.4	1.0	.8	.6	1.1
.....	1.7	1.8	1.8	1.3	.5	1.8	.4	1.0	1.0	.8	.7	1.0
.....	1.6	1.6	1.7	1.3	.6	1.0	.3	1.0	1.0	.7	.7	.9
.....	1.6	1.5	1.7	1.2	.5	1.0	.4	1.2	.8	.7	.8	.9
.....	1.5	1.3	1.6	1.1	.6	1.0	.3	1.0	.8	.7	.8	.8
.....	1.5	1.2	1.5	1.0	.6	1.0	.3	.8	.8	.7	.8	.8
.....	1.4	1.2	1.4	1.0	.5	1.0	.4	.8	.8	.5	.8	.8
.....	1.4	1.1	1.8	1.0	.5	1.0	.4	.2	1.8	.5	.9	1.7
.....	1.4	1.0	3.1	1.0	.5	2.4	.4	.8	1.0	.5	.9	1.6
.....	1.4	1.2	2.4	2.4	.5	2.0	.6	.8	1.0	.7	.9	1.6
.....	1.5	1.2	1.7	1.7	.4	1.0	.6	.6	1.0	.9	1.0	1.5
.....	1.7	1.0	1.6	1.3	.5	1.0	.7	.6	.8	.9	.9	1.5
.....	1.7	.9	1.6	1.0	.5	1.0	.6	.6	.8	.8	.8	1.5
.....	1.7	.7	1.5	.8	.4	.8	.6	.6	.8	.8	.4	1.5
.....	1.6	.7	1.5	.7	.4	.8	.5	.6	.6	.8	.7	1.5
.....	1.9	.6	1.5	.7	.4	.6	.8	.6	3.0	.8	.6	1.4
.....	2.0	.5	1.5	.6	.4	.5	.8	.6	1.0	.8	2.1	1.4
.....	1.9	.5	1.4	.9	.4	.5	.8	.4	1.0	.8	4.3	3.5
.....	2.0	.5	1.4	.6	.5	.5	.7	.4	1.0	.8	3.1	3.6
.....	3.0	18.8	2.5	.6	.3	.4	.8	.4	.8	.8	2.5	3.6
.....	3.8	.....	16.0	.6	.3	.4	.8	.4	.8	.8	2.1	3.0
.....	3.6	.....	5.4	.6	.3	.4	.8	.8	.8	.8	2.2	3.0
.....	3.4	.....	3.2	.....	.3	.....	.6	.8	.....	.8	.....	3.0
03.												
.....	2.5	1.0	9.2	3.9	1.7	4.5	1.2	.6	.5	.5	.7	.4
.....	1.5	1.1	4.0	3.4	1.7	7.2	1.2	.8	.5	.5	.8	.4
.....	1.0	1.6	2.0	2.9	1.6	4.7	1.1	1.1	.5	.5	1.0	.4
.....	1.0	3.2	2.5	2.8	1.8	4.0	1.7	.7	.5	.5	1.0	.4
.....	1.0	4.0	2.4	2.5	1.6	10.8	1.1	.7	.6	.5	1.5	.4

Daily gage height, in feet, of Etowah River at Canton—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
6	0.8	2.0	2.9	2.3	1.4	7.5	1.0	0.7	0.6	0.5	1.0	3.4
7	.8	2.6	2.3	2.2	1.4	6.0	1.0	.7	.5	.5	.7	4
8	.8	8.0	2.5	3.4	1.4	2.5	1.3	.6	.5	.5	.5	4
9	.8	4.2	2.6	3.4	1.4	2.5	1.2	.6	.5	.9	.5	4
10	.7	2.5	3.5	2.5	1.3	2.6	1.2	.6	.5	.6	.5	4
11	2.8	7.0	11.0	2.2	1.3	2.5	1.2	.6	.4	.6	.5	4
12	2.0	6.2	5.5	2.2	1.3	2.0	1.2	.7	.4	.6	.5	4
13	1.8	3.1	3.5	5.2	1.3	1.6	5.3	.7	.4	.6	.5	5
14	1.8	2.1	2.9	6.0	1.3	1.5	2.7	.7	.4	.6	.5	5
15	1.6	2.8	2.5	3.2	1.2	1.3	2.0	2.5	1.0	.6	.5	4
16	1.6	9.9	2.3	2.5	1.2	1.2	2.0	1.0	1.9	.6	.5	4
17	1.4	17.7	2.2	2.4	1.1	1.2	2.0	1.0	.8	.8	.5	4
18	1.4	5.1	2.0	2.3	1.1	1.2	1.9	2.2	.7	1.0	.5	4
19	1.3	3.2	1.9	2.1	1.1	1.2	1.7	1.0	.5	.8	.6	4
20	1.3	2.5	1.8	2.1	1.1	1.1	1.6	.9	.5	.8	.6	5
21	1.3	2.4	5.5	2.2	1.1	1.1	1.6	.8	.5	.7	.5	4
22	1.8	2.1	3.3	2.1	1.1	1.0	1.4	.8	.5	.7	.5	4
23	1.6	2.0	13.0	2.0	1.0	1.0	1.2	.7	.5	.6	.5	4
24	1.4	1.7	6.7	1.8	.9	1.0	1.0	.6	.5	.6	.5	4
25	1.2	1.5	5.5	1.7	.9	1.0	.9	.5	.5	.6	.5	
26	1.2	1.6	3.0	2.3	.9	1.0	.8	.5	.5	.6	.5	
27	1.2	1.5	2.6	1.8	.9	1.1	.7	.5	.5	.7	.5	
28	1.2	15.0	2.4	1.7	.9	3.0	.7	.5	.5	.7	.5	
29	1.2	.....	2.9	1.7	.9	1.7	.7	.5	.5	.7	.4	
30	1.2	.....	12.2	1.7	1.8	1.5	.6	.5	.5	.7	.4	
31	1.2	.....	5.5	.....	2.6	.....	.6	.5	.....	.7	.....	
1904.												
1	.4	.6	.7	.6	.5	1.3	.5	.5	.1	.4	.0	
2	.4	.6	.7	.6	.4	.6	.4	1.2	.1	.4	.1	
3	.4	.6	.9	.6	.3	.3	.3	1.2	.1	.3	.2	
4	.4	.6	.7	.4	.3	.1	.2	.5	.3	.3	.3	
5	.4	.6	.7	.4	.3	.0	.6	2.5	.3	.4	.4	
6	.4	.6	.7	.4	.2	.0	.4	.8	.3	.3	.3	
7	.5	.7	2.1	.7	.2	.5	.2	.4	.1	.3	.2	
8	.5	1.6	1.7	1.0	.8	.2	.3	8.0	.0	.35	.2	
9	.5	1.0	.9	.9	1.1	.0	.1	4.0	.0	.4	.2	
10	.5	.6	.8	.8	.6	— .1	.0	1.0	.0	.4	.2	
11	.6	.6	.8	.7	.3	— .1	.0	.8	— .1	.3	.2	
12	.6	.6	.8	.7	.3	— .1	.2	1.1	— .1	.3	.2	
13	.6	.7	.8	.6	.3	— .1	.8	.8	— .2	.4	.4	
14	.6	.7	2.0	.5	.3	— .1	.3	.5	— .1	.3	.3	
15	.5	.7	1.2	.5	.3	— .2	.1	.4	— .2	.4	.4	
16	.5	.7	.8	.5	.2	— .2	.0	.3	— .3	.3	.3	
17	1.1	.7	.8	.5	.2	— .2	.5	.3	— .3	.3	.3	
18	.9	.6	.7	.5	.2	— .2	.2	.2	— .3	.3	.3	
19	.7	.8	.7	.5	.2	— .3	.4	.1	— .3	.3	.3	
20	.6	2.5	.6	.5	.1	— .3	.0	.2	— .3	.3	.3	
21	.5	1.2	.6	.5	.1	.2	.0	.2	— .3	.3	.3	
22	.7	2.6	1.2	.6	.0	.1	— .1	.0	— .3	.2	.4	
23	1.7	1.0	.6	.5	.0	— .2	.1	.1	— .3	.1	.7	
24	1.0	1.0	.6	.4	.0	— .3	.1	.7	— .4	.2	.5	
25	.7	.8	.8	.4	.0	.1	.0	.5	— .4	.1	.4	
26	.7	.8	.8	.5	— .1	.0	.1	.3	— .4	.0	.3	
27	.7	.7	.8	.5	— .1	— .1	— .1	.4	— .4	.0	.3	
28	.7	.6	.7	.5	— .2	.1	.0	.3	— .2	.0	.3	
29	.8	.6	.7	.5	— .3	.6	.0	.1	— .2	.0	.3	
30	.7	.....	.7	.5	— .3	3.8	.0	.1	— .3	.0	.3	
31	.....	.....	.6	.....	1.3	.....	.0	.0	.....	.0	.....	
1905.												
1	.5	.5	.7	.7	.8	.6	1.7	.5	.2	.5	.1	
2	.5	.5	.7	.7	.7	.6	1.0	.4	2.0	.4	.0	
3	.6	.5	.6	.7	.6	.5	.8	.3	.6	.4	.0	
4	.5	.5	.6	.7	1.5	.5	.6	.2	.5	.3	.0	
5	.5	.6	.6	.8	.9	.5	1.8	.2	.4	.3	.0	
6	.6	.8	.7	.9	.9	.5	.7	.2	.3	.2	.0	
7	1.4	1.2	.8	.9	2.5	.5	1.7	.2	.2	.2	.0	
8	.8	1.2	.8	.9	1.4	.5	.9	.4	.2	.1	.1	
9	.7	3.7	.8	1.3	2.3	.4	1.7	.7	.1	.0	.1	
10	.6	4.0	1.7	1.0	1.1	.4	2.1	.4	.1	.1	.2	

Daily gage height, in feet, of Etowah River at Canton—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
.....	0.7	2.0	1.0	0.7	0.9	0.4	7.0	2.0	0.1	3.0	0.3	1.8
.....	9.4	1.5	1.0	1.0	.7	.4	4.0	2.5	.5	1.1	.2	1.0
.....	10.0	4.8	.9	1.0	.7	1.2	2.0	2.0	.3	.4	.2	.8
.....	2.2	2.8	.9	.7	.6	.5	1.5	1.0	.2	.2	.2	.6
.....	1.0	1.8	.8	.7	1.0	.7	1.2	1.5	.0	.1	.1	.8
.....	1.0	1.0	.8	1.0	4.0	.6	.9	1.0	.0	.3	.1	.7
.....	.8	1.0	.7	.7	.9	.7	.7	.8	.0	.2	.1	.6
.....	.8	.9	.7	.7	.8	.6	.5	.5	.0	.1	.1	.6
.....	.8	.9	.7	.7	.7	.6	.5	.5	.0	.1	.1	.6
.....	.7	1.8	.7	.6	.7	1.4	.7	.4	.0	.0	.2	.9
.....	.7	9.9	3.0	.6	.7	2.3	.4	.4	.0	.0	.4	3.1
.....	.6	3.9	1.5	.7	.7	3.7	.4	.3	.0	.0	.3	2.0
.....	.6	2.0	1.0	.6	1.0	2.0	.4	.3	— .1	.0	.2	1.6
.....	.5	1.3	1.0	.6	6.5	1.1	.4	.3	— .1	.0	.2	1.3
.....	.5	1.0	.9	.6	1.9	.9	.4	.8	— .1	.1	.4	1.0
.....	.5	.8	.9	.6	1.2	.9	.4	.4	— .1	.2	.5	.8
.....	.5	.8	.9	.6	1.1	.8	.3	.3	— .1	.5	.3	.7
.....	.5	.8	.8	.6	1.0	1.2	.3	.2	— .1	.3	.3	.7
.....	.5	.....	.8	.6	.9	1.1	1.3	.2	.0	.2	.3	1.2
.....	.6	.....	.8	1.3	.9	.9	.5	.2	.0	.1	.2	1.0
.....	.6	.....	.8	.....	.8	.....	.7	.2	.....	.1	.....	.8

Rating tables for Etowah River at Canton.

JANUARY 1 TO DECEMBER 31, 1896.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−0.75	200	0.50	810	1.80	1,880	3.20	3,460
−0.70	210	0.60	870	1.90	1,970	3.40	3,700
−0.60	240	0.70	950	2.00	2,060	3.60	3,940
−0.50	270	0.80	1,025	2.10	2,160	3.80	4,100
−0.40	320	0.90	1,110	2.20	2,260	4.00	4,350
−0.30	360	1.00	1,180	2.30	2,370	4.20	4,600
−0.20	410	1.10	1,250	2.40	2,480	4.40	4,850
−0.10	470	1.20	1,340	2.50	2,590	4.60	5,100
0.00	510	1.30	1,430	2.60	2,700	4.80	5,350
0.10	565	1.40	1,520	2.70	2,830	5.00	5,600
0.20	625	1.50	1,610	2.80	2,960		
0.30	680	1.60	1,700	2.90	3,100		
0.40	750	1.70	1,790	3.00	3,225		

JANUARY 1 TO OCTOBER 10, 1897, AND JULY 24 TO DECEMBER 31, 1898.[a]

−0.70	244	0.60	1,059	1.90	2,067	8.00	7,130
−0.60	284	.70	1,129	2.00	2,150	9.00	7,960
−0.50	344	.80	1,200	2.20	2,316	10.00	8,790
−0.40	405	.90	1,273	2.40	2,482	11.00	9,620
−0.30	467	1.00	1,347	2.60	2,648	12.00	10,450
−0.20	530	1.10	1,422	2.80	2,814	13.00	11,280
−0.10	593	1.20	1,498	3.00	2,980	14.00	12,110
0.00	657	1.30	1,576	3.50	3,395	15.00	12,940
.10	722	1.40	1,655	4.00	3,810	16.00	13,770
.20	788	1.50	1,735	4.50	4,225	17.00	14,600
.30	855	1.60	1,818	5.00	4,640	18.00	15,430
.40	922	1.70	1,901	6.00	5,470	19.00	16,260
.50	990	1.80	1,984	7.00	6,300	20.00	17,090

OCTOBER 11 TO DECEMBER 31, 1897.

0.10	335	0.60	763	1.10	1,198	1.60	1,633
0.20	415	0.70	850	1.20	1,285	1.70	1,720
0.30	502	0.80	937	1.30	1,372	1.80	1,807
0.40	589	0.90	1,024	1.40	1,459	1.90	1,894
0.50	676	1.00	1,111	1.50	1,546	2.00	1,981

[a] Above gage height 1.50 this table is a tangent, the difference being 83 per tenth.

Rating tables for Etowah River at Canton—Continued.

JANUARY 1 TO JULY 23, 1898.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	270	1.30	1,379	2.60	2,562	3.90	3,720
0.10	325	1.40	1,470	2.70	2,653	4.00	3,900
0.20	380	1.50	1,561	2.80	2,744	4.10	3,884
0.30	470	1.60	1,652	2.90	2,835	4.20	3,968
0.40	560	1.70	1,743	3.00	2,926	4.30	4,052
0.50	651	1.80	1,834	3.10	3,017	4.40	4,136
0.60	742	1.90	1,925	3.20	3,108	4.50	4,220
0.70	833	2.00	2,016	3.30	3,199	4.60	4,304
0.80	924	2.10	2,107	3.40	3,290	4.70	4,388
0.90	1,015	2.20	2,198	3.50	3,375	4.80	4,472
1.00	1,106	2.30	2,289	3.60	3,460	4.90	4,556
1.10	1,197	2.40	2,380	3.70	3,550	5.00	4,640
1.20	1,288	2.50	2,471	3.80	3,640		

JANUARY 1, 1899, TO JULY 31, 1902.[b]

−0.50	225	0.10	590	0.70	1,071	1.30	1,589
− .40	275	.20	665	.80	1,154	1.40	1,652
− .30	325	.30	740	.90	1,237	1.50	1,735
− .20	385	.40	820	1.00	1,320		
− .10	450	.50	905	1.10	1,403		
.00	515	.60	988	1.20	1,486		

AUGUST 1 TO DECEMBER 31, 1902.

0.20	350	1.30	1,130	2.40	2,120	3.50	3,110
.30	380	1.40	1,220	2.50	2,210	3.60	3,200
.40	420	1.50	1,310	2.60	2,300	3.70	3,290
.50	470	1.60	1,400	2.70	2,390	3.80	3,380
.60	530	1.70	1,490	2.80	2,480	3.90	3,470
.70	600	1.80	1,580	2.90	2,570	4.00	3,560
.80	680	1.90	1,670	3.00	2,660	4.20	3,740
.90	770	2.00	1,760	3.10	2,750	4.40	3,920
1.00	860	2.10	1,850	3.20	2,840		
1.10	950	2.20	1,940	3.30	2,930		
1.20	1,040	2.30	2,030	3.40	3,020		

JANUARY 1, TO AUGUST 15, 1903.[c]

0.60	800	1.30	1,450	2.00	2,080	2.70	2,710
.70	900	1.40	1,540	2.10	2,170	2.80	2,800
.80	1,000	1.50	1,630	2.20	2,260	2.90	2,890
.90	1,090	1.60	1,720	2.30	2,350	3.00	2,980
1.00	1,180	1.70	1,810	2.40	2,440		
1.10	1,270	1.80	1,900	2.50	2,530		
1.20	1,360	1.90	1,990	2.60	2,620		

AUGUST 16 TO DECEMBER 31, 1903.

0.40	430	0.90	780	1.40	1,220	1.90	1,670
.50	500	1.00	860	1.50	1,310	2.00	1,760
.60	570	1.10	950	1.60	1,400	2.10	1,850
.70	640	1.20	1,040	1.70	1,490	2.20	1,940
.80	710	1.30	1,130	1.80	1,580	2.30	2,030

JANUARY 1 TO DECEMBER 31, 1904.[d]

- 0.40	190	0.20	415	0.80	840	3.00	2,830
− .30	215	.30	470	.90	930	4.00	3,720
− .20	245	.40	532	1.00	1,020	5.00	4,620
− .10	280	.50	600	1.50	1,470	6.00	5,520
.00	320	.60	675	2.00	1,920	7.00	6,420
.10	365	.70	755	2.50	2,370	8.00	7,320

[a] Above gage height 5.00 feet this table is the same as the 1897 table. For the period July 24 to ber 31, 1898, use the table which is applicable from January 1 to October 10, 1897.
[b] Above gage height 1.50 feet this table is the same as the table from January 1 to October 10,
[c] Above gage height 3.00 feet this table is the same as the 1899 table.
[d] Above gage height 1.00 foot the rating curve is a tangent, the difference being 90 per tenth.

Estimated monthly discharge of Etowah River at Canton.

[Drainage area, 604 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1896.					
y	6,600	810	1,509	2.50	2.88
ry	3,850	870	1,603	2.65	2.86
	1,180	810	970	1.61	1.86
ber 9–30	950	200	280	.46	.38
r	2,320	270	476	.79	.91
ber	3,940	470	906	1.50	1.67
ber	1,180	470	598	.99	1.14
1897.					
y	3,478	593	1,194	1.98	2.28
ry	2,316	1,059	1,291	2.14	2.23
	6,466	1,059	2,335	3.86	4.45
	9,786	1,200	2,238	3.71	4.14
	2,150	722	1,036	1.72	1.98
	2,980	657	941	1.56	1.74
	6,383	657	1,186	1.96	2.26
	1,347	405	859	1.42	1.64
ber	1,200	284	355	.59	.65
r	1,285	244	583	.97	1.12
ber	937	335	563	.96	1.07
ber	1,981	676	934	1.55	1.79
he year	9,786	244	1,134	1.87	25.35
1898.					
y	5,138	380	1,121	1.86	2.14
ry	924	470	625	.98	1.02
	4,640	310	1,014	1.68	1.94
	3,460	560	1,160	1.92	2.14
	924	380	584	.97	1.12
	833	310	497	.82	.91
	6,549	380	1,388	2.30	2.66
	5,470	922	2,087	3.46	3.99
ber	10,035	922	1,964	3.25	3.62
r	11,695	855	2,286	3.78	4.36
ber	2,150	1,059	1,409	2.33	2.60
ber	2,483	1,498	1,913	3.17	3.66
he year	11,695	310	1,337	2.21	30.16
1899.					
y	8,790	1,652	2,396	3.97	4.58
ry, 25 days	8,790	1,652	2,987	4.95	4.30
	15,596	1,652	3,382	5.60	6.45
	4,474	1,652	2,344	3.88	4.33
	1,984	1,320	1,681	2.78	3.21
	4,142	1,320	1,644	2.72	3.03
	3,810	1,320	1,770	2.93	3.38
	1,984	1,154	1,534	2.54	2.93
ber	1,154	325	729	1.21	1.35
r	665	225	472	.78	.90
ber	1,403	450	614	1.02	1.14
ber	2,980	590	1,008	1.82	2.10
he year	15,596	225	1,721	2.85	38.55
1900.					
y	1,818	820	976	1.62	1.87
ry	12,276	988	2,138	3.54	3.68
	4,972	1,154	1,989	3.29	3.79
	4,640	1,154	1,956	3.24	3.61
	1,984	1,237	1,395	2.31	2.67
9	5,470	1,052	3,183	5.27	1.76
	3,810	1,320	1,853	3.07	3.54
	2,980	988	1,371	2.27	2.62
ber	4,640	740	1,347	2.23	2.49
r	6,466	665	2,038	3.37	3.88
ber	4,308	1,071	1,970	3.26	3.63
ber	2,814	740	1,264	2.09	2.41

Estimated monthly discharge of Etowah River at Canton—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.					
January	14,185	988	1,965	3.25	3.75
February	5,470	1,154	2,135	3.53	3.69
March	14,600	988	1,890	3.13	3.61
April	4,474	1,154	2,299	3.81	4.25
May	14,268	1,154	2,394	3.96	4.57
June	4,889	1,154	2,442	4.04	4.51
July	2,648	905	1,317	2.18	2.51
August	11,280	820	2,533	4.19	4.83
September	2,814	988	1,483	2.46	2.74
October	2,897	590	1,039	1.72	1.98
November	1,320	905	1,052	1.74	1.94
December	17,090	988	2,715	4.50	5.19
The year	17,090	590	1,938	3.21	43.56
1902.					
January	3,644	1,652	2,300	3.81	4.39
February	16,094	905	2,698	4.47	4.65
March	13,770	1,652	2,929	4.85	5.59
April	2,814	988	1,533	2.54	2.83
May	1,403	740	950	1.57	1.81
June	2,482	740	1,215	2.01	2.24
July	1,154	740	920	1.52	1.75
August	1,040	350	562	.93	1.07
September	2,660	530	897	1.49	1.66
October	2,480	470	725	1.20	1.38
November	3,830	420	978	1.62	1.81
December	3,740	680	1,737	2.88	3.32
The year	16,094	350	1,454	2.41	32.50
1903.					
January	2,800	900	2,136	3.54	4.08
February	15,181	1,180	3,934	6.52	6.75
March	11,280	1,900	4,004	6.63	7.64
April	5,470	1,810	2,618	4.34	4.84
May	2,620	1,090	1,450	2.40	2.77
June	9,454	1,180	2,640	4.37	4.88
July	4,889	800	1,544	2.56	2.95
August	2,530	500	856	1.42	1.64
September	1,670	430	558	.92	1.03
October	860	500	598	.99	1.14
November	1,310	430	586	.97	1.08
December	570	430	459	.76	.88
The year	15,181	430	1,782	2.95	39.72
1904.					
January	1,650	532	720	1.19	1.37
February	2,460	675	916	1.52	1.64
March	2,010	675	914	1.51	1.74
April	1,020	532	650	1.08	1.20
May	1,290	215	469	.776	.895
June	3,540	215	479	.793	.885
July	840	280	418	.692	.798
August	7,320	320	979	1.62	1.87
September	470	190	278	.460	.513
October	320	190	236	.391	.451
November	775	320	480	.795	.887
December	2,370	532	724	1.20	1.38
The year	7,320	190	605	1.00	13.63

ETOWAH RIVER AT ROME.

Measurements were made at this station for several years in connection with the measurement of Coosa River at Rome. Measurements were referred to a bench mark on the bridge, and the gage put in July 1, 1903, by J. M. Giles was referred to the same bench mark. This gage is located at the Second Avenue Bridge in the city of Rome, Ga., about 1 mile above the mouth of the river.

The channel is curved for 1,000 feet above and below the station. Both banks are high and overflow only under the approaches to the bridge. The bed of the stream is of rock and is permanent, but the channel is obstructed by the crib of an old pier foundation in the middle of the river. Discharge measurements have been made from the sidewalk on the upstream side of the single-span iron bridge and its approaches. The initial point for soundings is the center of the post at the end of the iron hand rail on the right bank, upstream side. The gage is a vertical timber driven into the bed of the river and spiked to a birch tree on the left bank about 50 feet below the bridge. The bench mark is the top of the downstream end of the third crossbeam from the left bank end of the bridge; elevation, 43.00 feet above the zero of the gage. The station was discontinued December 31, 1903.

Discharge measurements of Etowah River at Rome.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*	1903.	*Feet.*	*Sec.-ft.*
March 14	9.55	6,316	July 18	2.98	2,376
June 5	15.65	17,130	September 4	1.20	1,293
July 1	3.27	2,986	November 28	1.01	1,080
July 3	3.15	2,704			

Daily gage height, in feet, of Etowah River at Rome.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.							1903.						
1	3.3	3.0	1.0	1.0	1.0	1.0	17	3.4	2.9	2.0	1.2	1.3	1.0
2	3.0	3.6	.9	1.0	1.0	1.0	18	3.2	2.7	1.9	.....	1.5	1.0
3	3.3	3.4	.8	.9	1.3	1.0	19	3.1	2.4	1.8	.....	2.2	1.0
4	3.0	3.3	.7	.8	1.9	1.0	20	3.0	2.2	1.8	.....	1.8	1.0
5	3.5	4.0	.6	.8	2.8	1.0	21	2.9	2.0	1.7	.....	1.3	1.0
6	2.7	3.2	.6	.8	2.2	1.0	22	2.8	1.7	1.6	.....	1.2	1.0
7	2.7	2.9	.6	.7	2.0	1.0	23	2.7	1.6	1.5	.....	1.1	1.0
8	3.1	2.7	.6	.8	1.8	1.0	24	2.5	1.6	1.5	.....	1.1	1.1
9	3.4	2.3	.5	1.0	1.3	1.0	25	2.4	1.5	1.4	.....	1.1	1.2
10	3.3	2.1	.5	1.7	1.0	1.2	26	2.3	1.4	1.3	.....	1.0	1.3
11	3.2	1.9	.5	1.6	1.1	1.1	27	2.4	1.3	1.2	.....	1.0	1.3
12	3.2	1.8	.5	1.4	1.0	1.0	28	2.4	1.3	1.2	.....	1.0	1.3
13	8.6	1.7	.5	1.1	1.6	1.0	29	2.3	1.2	1.1	1.0	1.0	1.3
14	9.0	1.6	.6	1.1	1.5	1.0	30	2.9	1.2	1.1	1.1	1.0	1.3
15	6.4	1.8	1.0	1.0	1.3	1.0	31	2.8	1.1	.....	1.0	.....	1.2
16	4.6	4.1	2.0	1.0	1.3	1.0							

Rating table for Etowah River at Rome from July 1 to December 31, 1903.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	900	1.80	1,598	3.20	2,772	5.80	6,180
.60	944	1.90	1,665	3.40	3,010	6.00	6,470
.70	989	2.00	1,733	3.60	3,250	6.20	6,770
.80	1,035	2.10	1,801	3.80	3,490	6.40	7,070
.90	1,082	2.20	1,869	4.00	3,730	6.60	7,375
1.00	1,130	2.30	1,937	4.20	3,975	6.80	7,685
1.10	1,179	2.40	2,005	4.40	4,224	7.00	8,000
1.20	1,230	2.50	2,077	4.60	4,478	7.50	8,800
1.30	1,285	2.60	2,155	4.80	4,741	8.00	9,600
1.40	1,344	2.70	2,241	5.00	5,020	8.50	10,400
1.50	1,405	2.80	2,335	5.20	5,310	9.00	11,200
1.60	1,468	2.90	2,437	5.40	5,600		
1.70	1,532	3.00	2,546	5.60	5,890		

Estimated monthly discharge of Etowah River at Rome.

[Drainage area, 1,854 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
July	11,200	1,937	3,246	1.75	2.0
August	3,852	1,179	2,001	1.08	1.2
September	1,733	900	1,206	.65	.7
October 1-17 and 29-31	1,532	989	1,162	.63	.7
November	2,335	1,130	1,359	.73	.8
December	1,285	1,130	1,168	.63	.7

ETOWAH RIVER NEAR ROME.

This station was established August 17, 1904, by M. R. Hall. It is located at Freemans Ferry, about 5 miles above Rome.

The channel is straight for about 3,000 feet above and 1,000 feet below the station. The current is swift. There is a small shoal of rock about 50 feet below the gaging section. About 1,000 feet below there is an old fish-trap dam, but this has not been used for years, and is probably constant. Both banks are high, but are subject to overflow during high water. The bed of the stream is composed of small rock and pebbles, and is uniform and permanent. There is but one channel at all stages, the water being about 2.5 feet deep at low water. Discharge measurements are made from a small boat, the meter being suspended from the ferry cable. Measurements can be made from the bridge at Rome, as no large quantity of water enters the river between the ferry and that place. The initial point for soundings is the center of the windlass for the ferry cable on the left bank of the river.

The original gage, reading from 0 to 7 feet, is attached to a sycamore tree at left edge of river, about 250 feet below the ferry. A second section, reading from 7 to 20 feet, is attached to a post 10 feet upstream from the first section and 10 feet from the edge of the river at low water. A third section, reading from 20 to 30 feet, is attached to a maple tree opposite the post and 15 feet farther from the waters edge. The gage is read once each day by W. A. Gresham, who is paid by the Georgia Geological Survey. Bench marks were established as follows: (1) Head of lag screw driven into root of maple, to which gage 20 to 30 feet is attached; elevation, 19.26 feet. (2) Center mark on copper plug set horizontally in brick wall of F. B. Freeman's residence, on east end of house, near northeast corner, just below floor level; elevation, 27.99 feet. Elevations refer to the datum of the gage.

Discharge measurements of Etowah River near Rome.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec.-ft.*
st 18 [a]	2.00	1,049	February 28	3.10	2,468
st 18 [b]	2.03	1,064	May 12	2.40	1,613
mber 27 [b]	1.37	470	July 24	2.11	1,168
er 15 [b]	1.26	397	October 9	1.76	862
nber 8 [b]	1.50	574	October 9	1.76	850

[a] At Rome, Second Avenue Bridge. [b] At Freeman's ferry, 5 miles above Rome.

Daily gage height, in feet, of Etowah River near Rome.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
904.						1904.					
		1.75	1.3	1.3	1.55	17	2.1	1.4	1.3	1.6	1.7
		1.75	1.3	1.3	1.55	18	2.05	1.4	[a] 1.3	1.55	1.75
		1.7	1.25	1.5	1.6	19	2.1	1.4	1.25	1.55	1.7
		1.7	1.35	1.4	1.7	20	1.85	1.4	1.35	1.55	1.7
		1.75	1.3	1.5	1.8	21	1.8	1.4	1.3	1.55	1.65
		1.8	1.3	1.6	3.1	22	2.5	1.4	1.3	1.55	1.6
		1.7	1.3	1.55	3.0	23	1.7	1.4	1.3	1.6	1.6
		1.65	1.3	1.55	2.2	24	3.4	1.4	1.2	1.9	1.6
		1.6	1.25	1.55	1.9	25	[a] 3.0	1.35	1 25	1.75	1.6
		[a] 1.6	1.2	1.55	1.8	26	2.1	1.35	1.3	1.6	1.7
		1.6	1.35	1.4	1.9	27	[a] 2.5	1.35	1.3	1.6	1.7
		1.6	1.35	1.4	1.95	28	2.8	1.35	1.3	1.55	3.0
		1.5	1.4	[a] 1.5	1.8	29	2.3	1.35	1.3	1.55	3.4
		1.5	1.3	1.6	1.7	30	1.9	1.35	1.3	1.55	2.5
		1.5	1.3	1.75	1.7	31	1.9	.....	1.3	.....	2.0
		1.45	1.3	1.6	1.65						

Gage height interpolated August 25 and 27, September 10, October 18, and November 13, 1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
	2.0	2.3	3.0	2.5	2.9	2.4	2.4	2.1	1.9	2.7	1.9	2.0
	2.0	2.3	2.9	2.5	2.5	2.3	3.2	2.1	2.0	2.8	1.8	2.1
	1.9	2.2	2.8	2.5	2.4	2.3	2.9	2.1	2.5	2.1	1.7	15.2
	2.0	2.1	2.8	2.4	2.4	2.3	2.4	2.1	3.0	2.0	1.7	16.2
	1.9	2.1	2.7	2.4	3.0	2.4	2.5	2.1	2.9	1.8	1.6	9.1
	2.3	2.2	2.7	2.7	2.7	2.3	2.8	2.1	2.0	1.8	1.6	3.9
	2.6	2.25	2.6	2.7	2.7	2.3	4.6	2.1	1.9	1.7	1.6	3.0
	2.35	3.0	2.6	2.7	3.3	2.2	4.1	2.1	1.9	1.7	1.5	4.1
	2.3	7.7	2.7	2.6	2.8	2.2	4.4	2.0	1.8	1.6	1.6	13.5
	2.2	8.4	2.9	2.8	3.3	2.2	4.8	2.5	1.8	2.1	2.1	9.4
	3.4	5.9	3.3	2.6	2.7	2.2	3.9	2.9	1.8	3.0	2.1	4.5
	4.7	4.3	2.9	2.6	2.5	2.2	7.0	3.8	2.9	3.7	2.0	3.8
	15.7	4.5	2.9	3.0	2.4	2.2	6.0	3.1	3.0	2.6	2.0	4.1
	9.3	7.4	2.8	2.9	2.3	2.3	4.0	2.9	2.1	2.5	1.9	4.5
	6.2	4.7	2.7	2.7	2.3	2.6	2.9	5.1	2.0	2.3	1.8	4.9
	3.1	3.7	2.6	2.7	4.9	2.5	2.7	4.0	1.9	2.4	1.8	3.8
	2.8	3.3	2.5	2.9	4.8	2.5	2.5	3.4	1.8	2.3	1.7	3.6
	2.5	3.2	2.5	2.6	3.8	2.3	2.4	2.6	1.8	2.3	1.6	3.2
	2.5	3.0	2.5	2.5	2.7	2.3	2.4	2.5	1.8	2.3	3.3	2.9
	2.5	3.3	2.6	2.4	2.4	2.5	2.3	2.5	1.7	2.2	2.0	4.0
	2.5	11.0	4.2	2.4	2.8	2.9	2.3	2.4	1.8	2.1	1.9	.....
	2.5	10.0	4.5	2.5	3.5	2.5	2.4	2.3	1.7	2.0	1.8	.....
	2.4	5.8	3.5	2.5	4.2	2.6	2.3	2.3	1.7	1.9	1.8	.....
	2.35	4.5	3.0	2.4	9.0	3.8	2.1	3.0	1.7	1.9	1.9	4.2
	2.35	3.8	2.9	2.4	4.8	2.6	2.1	3.0	1.7	2.0	2.1	3.8
	2.2	3.5	2.8	2.4	3.6	2.3	2.2	2.6	1.6	2.2	2.0	3.5
	2.0	3.2	2.7	2.4	3.6	2.3	2.1	2.3	1.6	2.3	2.4	3.2
	2.0	3.1	2.7	2.4	3.2	2.8	2.1	2.3	1.6	2.4	2.3	3.2
	2.0	.....	2.6	2.3	2.8	3.0	2.3	2.2	1.6	1.9	2.3	3.3
	1.9	.....	2.5	.....	2.6	2.8	2.3	2.0	1.7	1.9	2.0	3.3
	2.4	.....	2.5	.....	2.5	.....	2.2	1.9	.....	.....	.....	3.0

Rating table for Etowah River near Rome, from August 17, 1904, to December 31, 1

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	360	1.80	830	2.40	1,500	3.00	2,320
1.30	425	1.90	930	2.50	1,625	3.20	2,625
1.40	495	2.00	1,035	2.60	1,755	3.40	2,950
1.50	570	2.10	1,145	2.70	1,890		
1.60	650	2.20	1,260	2.80	2,030		
1.70	735	2.30	1,380	2.90	2,175		

a This station was established for low-water records, and only these are reliable. The above table is applicable only to gage heights less than 3.5 feet. As it does not apply to the higher gage h no monthly estimates have been made for 1905.

Estimated monthly discharge of Etowah River near Rome.

[Drainage area, 1,854 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	De in
1904.					
August (17-31)	2,950	735	1,384	0.746	
September	830	460	588	.317	
October	495	360	423	.228	
November	930	425	614	.331	
December	2,950	610	1,027	.554	

AMICALOLA RIVER NEAR BALLGROUND.

This station was established in 1905. It is located at Hollensl Bridge, one-fourth of a mile above Heard's mill, and about 15 n northeast of Ballground.

Discharge measurements are made from the two-span cov bridge, about 150 feet in total length. The meter can be let d through the floor at the side of the bridge, but the current he rough and not good for measurements. Some of the measurem were made about 40 feet below the bridge. The stream is import and a good section is difficult to find, but it is probable that a be place than this will be found.

Gage heights are determined directly from the bench mark, whi a point on top of the downstream end of the wooden floor beam feet from the left-bank pier; elevation, 17.00 feet above the datu the assumed gage.

Discharge measurements of Amicalola Creek near Ballground.

Date.	Gage height.	I ch
1905.	*Feet.*	*Se*
June 23	1.58	
November 16a	1.35	
November 16a	1.35	

a Made at different section.

LONG SWAMP CREEK NEAR BALLGROUND.

This station was established in 1905. It is located at a wooden wagon bridge about 2 miles southeast from Ballground, and half a mile above the mouth of the creek, which empties into Etowah River.

The current is swift at the station, also above and below it. The bed is sandy, and the water is shallow. Measurements are made from the downstream side of the wooden bridge of three spans. The middle span, which includes all of the creek at all but high stages, is 50 feet long, and the two end spans are 35 feet each. Gage heights are determined directly from the bench mark, which is a nail driven horizontally into the upstream side of a large sycamore tree on the right bank about 100 feet below the bridge; elevation, 8.00 feet above the datum of the assumed gage.

Discharge measurements of Long Swamp Creek near Ballground.

Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*
June 24	1.27	93
November 15	.84	50

COOSA RIVER AT ROME.

Coosa River is formed at Rome by the junction of Etowah and Oostanaula rivers. Both the tributary rivers rise in the northern part of Georgia and flow for the most part through a hilly, broken country, well wooded, about one-fourth of the land being under cultivation. The channel of the Etowah is straight and the current swift and unobstructed, but the Oostanaula is rather sluggish and somewhat obstructed by piers. The banks are high and are liable to overflow at high stages. The gage is in two sections: The first, 0 to 5 feet, is fastened to the downstream left-hand corner of the cofferdam around the center pier of the turn span; the second, 5 to 44 feet, is fastened to the downstream side of the same pier. The zero of the gage is 576 feet above sea level.

The measurements at Rome are made on the Oostanaula and the Etowah just above their junction. The Etowah is measured at the Second Avenue Bridge, and the Oostanaula at the Fifth Avenue Bridge in Rome, and the results are added to give the flow of the Coosa. The gage height is taken from the United States Weather Bureau gage at the Fifth Avenue Bridge on the Oostanaula. There is practically no fall on Oostanaula River from the Fifth Avenue Bridge to the junction; hence the gage is used as a Coosa River gage, and the gage heights are considered as gage heights of Coosa River. The

Weather Bureau established this gage in 1890, but now maintains it only from November 1 to April 30; W. M. Towers, the observer, has, however, furnished the Geological Survey with monthly reports of the daily gage height for the entire year.

The station was discontinued December 31, 1903, on account of the uncertain velocity at low stages of the Oostanaula section.

Discharge measurements of Coosa River at Rome.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
1896.		
September 29	0.20	1,209
1897.		
May 7	2.75	4,646
October 5	.15	990
1898.		
May 11	1.90	2,946
September 17	2.60	3,913
October 11	5.05	8,324
October 22	4.10	6,489
November 10	3.90	6,039
1899.		
January 25	3.80	6,540
January 25	3.60	5,932
May 19	2.75	4,394
June 16	2.40	3,352
August 4	1.45	2,835
October 13	.60	1,769
1900.		
February 21	4.80	8,115
1900.		
May 19	2.30	4,[illegible]
September 13	.90	1,[illegible]
December 8	3.73	6,[illegible]
1901.		
January 23	3.60	5,[illegible]
April 5	9.90	15,[illegible]
June 22	3.70	6,[illegible]
October 15	3.15	5,[illegible]
1902.		
June 24	1.30	2,[illegible]
October 8	.80	1,[illegible]
November 8	1.10	2,[illegible]
1903.		
March 14	9.70	15,[illegible]
June 5	12.55	23,[illegible]
July 1	2.80	5,[illegible]
July 3	2.70	4,[illegible]
July 18	2.85	4,[illegible]
September 4	.90	2,[illegible]
November 28	.75	1,[illegible]

Daily gage height, in feet, of Coosa River at Rome.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1897.												
1	1.0	2.8	3.3	7.1	4.1	1.8	1.7	0.8	1.0	0.0	0.5	1.[illegible]
2	1.0	9.7	3.2	7.5	4.0	2.3	1.5	.7	.5	.0	.9	1.[illegible]
3	1.0	11.5	3.1	8.2	3.5	2.0	1.0	1.2	.3	.0	1.0	[illegible]
4	1.0	9.6	3.3	9.4	3.3	3.0	.9	1.0	.5	— .1	1.0	[illegible]
5	1.0	8.2	3.5	14.8	3.0	2.4	2.0	.8	.4	— .1	1.0	[illegible]
6	1.3	5.2	7.6	18.9	3.0	2.0	1.9	.8	.3	— .1	.8	[illegible]
7	1.1	5.0	19.7	17.0	3.0	2.0	1.9	1.9	.3	— .1	.6	[illegible]
8	1.1	4.3	18.9	14.7	2.8	2.0	3.0	2.0	.2	— .1	.8	[illegible]
9	1.0	5.0	15.4	12.1	2.6	2.0	2.1	2.0	.1	— .1	.8	[illegible]
10	1.0	4.4	13.5	9.6	2.6	1.9	1.9	1.6	.0	— .1	.7	[illegible]
11	.9	4.5	12.0	7.2	2.6	1.9	2.5	2.4	.0	— .1	.7	[illegible]
12	.9	7.4	11.5	6.2	3.0	1.9	2.8	1.8	.0	1.1	.7	[illegible]
13	.9	8.7	18.6	5.8	3.4	1.8	2.0	1.3	.0	1.6	.7	[illegible]
14	2.8	7.2	21.3	5.0	4.0	1.7	1.6	.8	.0	1.3	.6	[illegible]
15	6.2	5.5	23.8	6.0	5.0	1.7	1.3	.6	.0	1.0	.6	4.0
16	5.0	4.5	23.4	7.4	4.0	2.0	1.0	.6	.0	.8	.6	[illegible]
17	3.5	4.0	22.6	7.0	3.3	2.8	5.2	2.1	.0	.7	.6	[illegible]
18	3.9	3.7	21.4	5.0	2.8	2.3	4.2	3.2	— .1	.6	.6	[illegible]
19	5.0	3.4	19.7	4.5	2.7	2.0	4.8	2.4	— .2	.6	.6	[illegible]
20	3.5	3.0	18.9	4.0	2.6	1.8	8.8	1.4	— .2	.6	.6	[illegible]
21	8.7	4.0	17.7	3.8	2.5	1.6	12.8	1.3	— .2	1.5	.6	[illegible]
22	9.5	3.9	15.3	3.7	2.4	1.5	7.3	1.5	— .2	1.3	.5	[illegible]
23	5.7	5.6	13.7	3.5	2.4	1.5	4.4	1.5	— .2	1.0	.5	[illegible]
24	4.0	11.7	12.9	3.5	2.4	1.4	3.9	1.5	— .2	.8	.5	[illegible]
25	3.5	8.6	9.1	3.5	2.3	1.3	2.6	1.1	— .3	.8	.5	[illegible]
26	3.0	6.7	6.0	3.5	2.2	1.2	2.6	.8	— .3	.7	.5	[illegible]
27	2.5	4.7	5.2	3.4	2.1	1.2	3.8	.5	— .4	.7	.5	[illegible]
28	2.5	3.5	4.8	3.4	2.0	1.0	3.0	.4	— .4	.7	.9	[illegible]
29	2.5	.....	4.5	3.4	2.0	1.1	2.4	.4	— .4	.6	1.1	[illegible]
30	2.3	.....	4.2	3.2	1.9	2.0	1.4	.4	— .4	.5	1.1	[illegible]
31	2.2	.....	4.0	.....	1.9	.....	1.2	.5	.....	.5	.....	[illegible]

Daily gage height, in feet, of Coosa River at Rome—Continued.

y.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
8.												
.....	1.8	3.6	1.2	9.0	2.8	1.4	1.2	4.8	2.0	2.0	2.2	4.2
.....	1.8	3.1	1.2	6.1	2.6	1.4	1.0	4.4	7.8	2.0	2.2	4.0
.....	1.7	2.8	1.2	4.2	2.4	1.4	1.0	3.2	21.7	2.0	2.2	3.8
.....	1.7	2.6	1.2	3.6	2.3	1.4	1.0	4.4	24.3	4.9	2.2	3.8
.....	1.6	2.4	1.2	9.9	2.2	1.3	1.0	8.0	22.2	22.0	2.0	4.3
.....	1.6	2.2	1.2	17.2	2.1	1.3	1.3	5.6	20.0	23.8	2.2	5.0
.....	1.3	2.0	1.2	14.5	2.0	1.3	2.0	4.4	17.6	19.0	2.6	4.3
.....	1.3	1.8	1.2	10.9	2.0	1.3	2.8	4.4	16.4	18.4	2.4	4.0
.....	1.3	1.8	1.2	7.0	2.0	1.3	3.2	3.4	9.7	16.6	2.3	3.7
.....	1.3	1.7	1.2	4.1	2.0	1.3	1.7	3.0	5.0	14.0	2.1	3.4
.....	1.4	1.5	1.2	4.0	2.0	1.3	2.8	9.9	5.4	5.6	2.0	3.3
.....	2.0	1.5	1.2	3.8	1.9	1.2	2.0	7.2	4.6	4.2	2.0	3.3
.....	2.0	1.3	1.2	3.6	1.8	1.4	1.8	4.2	3.8	3.8	2.0	3.2
.....	4.0	1.3	1.3	3.5	1.8	1.8	1.6	3.4	3.2	3.7	2.3	3.0
.....	3.8	1.3	1.6	3.5	1.7	1.8	3.7	3.0	3.0	3.5	2.3	3.0
.....	3.6	1.3	3.7	3.4	1.6	1.7	3.7	2.5	2.9	3.2	2.9	2.8
.....	3.6	1.2	7.3	3.0	1.5	1.8	2.2	2.0	2.7	3.1	2.9	2.7
.....	3.2	1.2	5.8	3.0	1.5	1.8	1.9	2.2	2.5	6.5	4.0	2.6
.....	2.8	1.2	3.7	3.0	1.5	2.2	1.7	2.2	2.3	9.0	5.0	2.6
.....	4.4	1.2	3.0	3.6	1.4	3.6	1.6	3.2	2.2	6.0	4.5	2.6
.....	6.5	1.2	2.5	3.6	1.4	3.2	1.5	2.8	2.2	4.2	5.0	2.8
.....	6.4	1.2	2.5	3.2	1.4	3.0	1.4	3.9	2.3	3.9	4.0	2.9
.....	5.0	1.2	2.3	3.0	1.4	2.8	1.3	2.2	2.6	4.0	5.0	3.2
.....	4.5	1.2	2.2	7.2	1.4	2.6	1.8	2.2	4.1	3.9	7.0	3.6
.....	7.0	1.2	2.1	8.2	1.4	2.0	3.7	1.9	3.1	3.5	4.7	3.0
.....	14.0	1.2	2.0	6.0	1.4	1.8	3.8	2.7	3.0	3.3	3.9	2.9
.....	14.6	1.2	1.9	4.6	1.4	1.8	2.9	4.0	2.7	3.1	4.5	2.7
.....	11.6	1.2	1.8	4.0	1.4	1.8	3.7	4.4	2.5	3.0	4.3	2.6
.....	8.6	.....	2.0	3.7	1.4	1.6	4.2	3.4	2.3	2.8	4.3	2.5
.....	4.6	.....	8.5	3.2	1.4	1.4	4.1	2.0	2.1	2.6	3.9	2.4
.....	3.9	.....	11.4	.....	1.4	.....	4.2	2.3	.....	2.4	.....	2.4
9.												
.....	3.0	6.9	19.7	13.2	4.0	3.0	1.7	2.2	3.4	.4	.7	1.1
.....	3.4	7.8	15.0	10.6	3.7	2.6	1.5	1.9	2.0	.3	.6	1.1
.....	3.0	6.0	8.6	7.9	3.7	2.6	1.0	1.7	1.6	.3	.5	1.5
.....	2.7	9.2	6.6	7.2	3.5	2.0	.9	1.5	1.4	.3	.5	1.3
.....	2.6	15.3	7.8	9.5	3.5	2.0	2.0	1.4	1.3	.3	.4	1.1
.....	2.6	18.2	9.0	8.2	3.5	2.0	1.9	1.5	1.3	.5	.4	1.0
.....	3.6	27.8	8.0	8.2	3.7	2.0	1.9	1.6	1.2	.7	.3	.9
.....	5.9	24.0	6.8	15.0	3.7	1.9	3.0	1.5	1.0	.7	.3	.8
.....	5.9	22.4	5.7	13.4	3.6	1.8	2.1	1.8	1.0	.8	.3	.8
.....	4.9	21.0	5.4	11.2	3.5	1.8	1.9	1.6	1.0	.6	.3	.8
.....	4.0	19.0	5.2	9.5	3.3	1.8	2.5	1.4	2.9	1.0	.3	.8
.....	4.5	16.5	4.9	7.0	3.1	2.2	2.8	1.4	2.3	.9	.3	2.8
.....	4.0	7.0	4.5	6.4	3.1	3.8	2.0	1.2	1.5	.7	.3	6.1
.....	3.8	5.0	6.0	5.9	3.0	4.0	1.6	1.1	1.0	.7	.4	5.0
.....	3.6	5.0	16.6	5.6	3.0	3.5	1.3	1.3	.9	.6	.4	3.2
.....	3.6	5.5	27.7	5.4	2.9	2.5	1.8	1.9	.8	.6	.5	2.0
.....	4.0	8.9	29.2	5.2	2.8	2.1	5.2	1.6	.6	.6	.9	1.8
.....	4.2	9.5	25.8	4.8	2.8	2.0	4.2	1.4	.6	.6	.7	1.7
.....	4.0	8.5	24.9	4.7	2.8	2.0	4.8	1.1	.6	.6	.5	1.3
.....	3.7	7.7	26.2	4.6	2.8	2.0	8.8	.9	.7	.6	.5	1.6
.....	3.3	6.8	24.6	4.3	2.6	1.8	12.8	.9	.7	.7	.5	2.0
.....	3.2	6.9	23.0	4.1	2.6	2.2	7.9	.8	.6	.7	.4	2.0
.....	3.1	7.3	22.6	4.0	2.4	1.7	4.8	.8	.6	.6	1.0	1.8
.....	3.5	6.6	21.9	5.4	2.6	1.7	3.9	.7	.5	.5	2.1	7.2
.....	3.8	5.8	18.0	7.4	2.5	1.7	2.6	.7	.5	.4	1.5	7.5
.....	3.8	5.5	10.5	9.1	2.4	1.7	2.6	.7	.5	.4	2.5	5.0
.....	3.3	19.1	7.7	6.7	2.2	2.1	3.8	2.5	.5	.4	3.0	3.5
.....	3.0	23.4	6.8	5.5	2.2	1.9	3.0	2.5	.6	.4	2.2	3.0
.....	3.0	.....	8.8	4.8	2.0	1.9	2.4	2.5	.5	.4	1.9	3.0
.....	2.9	.....	9.3	4.2	2.0	1.8	1.4	2.0	.4	.5	1.4	3.4
.....	4.4	.....	10.2	.....	3.3	.....	1.2	2.5	.....	.8	.....	2.0
0.												
.....	2.0	2.0	4.2	4.4	6.2	2.4	10.5	3.4	1.5	1.2	2.1	3.2
.....	1.6	1.8	5.8	4.2	4.8	2.5	8.0	3.2	1.5	1.2	2.2	2.8
.....	1.5	1.6	5.6	4.0	4.0	2.8	8.0	3.0	1.7	1.0	2.0	2.6
.....	1.5	2.0	4.4	4.0	4.0	4.2	7.0	2.8	1.7	1.0	2.3	3.5
.....	1.5	3.0	4.1	4.0	3.8	4.2	5.5	2.6	1.5	.9	2.3	7.4

Daily gage height, in feet, of Coosa River at Rome—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
6	1.5	3.8	3.8	4.0	3.7	4.2	4.2	2.5	1.5	0.9	2.1	6.6
7	1.5	2.8	5.0	3.8	3.6	4.8	3.8	2.2	1.4	.9	2.1	5.2
8	1.5	2.4	8.2	3.8	3.4	13.0	3.8	2.2	1.0	3.8	2.0	3.6
9	1.5	4.0	15.0	3.6	3.0	12.6	4.3	2.0	1.0	5.9	1.9	3.4
10	1.5	6.9	13.4	3.5	3.0	8.0	4.3	2.0	.8	2.6	1.8	3.2
11	2.0	7.0	10.3	6.0	3.0	5.9	3.8	1.8	.8	2.0	1.8	2.9
12	7.0	6.4	7.5	11.0	3.0	5.0	3.4	1.8	.8	1.8	1.6	2.6
13	9.0	22.6	5.5	7.4	2.5	5.2	3.8	1.8	.8	2.5	1.5	2.6
14	7.2	27.2	4.8	5.5	2.4	5.3	3.4	1.7	.8	3.2	1.5	2.4
15	5.5	25.3	4.2	4.5	2.4	4.2	3.4	2.0	6.5	3.0	1.5	2.2
16	3.5	21.2	5.3	5.6	2.4	3.8	3.3	1.7	11.1	2.0	1.5	2.2
17	3.0	18.0	5.6	6.2	2.4	4.8	3.1	1.6	7.0	1.6	1.5	2.2
18	2.9	10.7	4.5	11.0	2.4	6.0	3.0	1.8	3.2	1.5	1.4	2.6
19	5.0	5.0	5.2	11.1	2.9	6.5	2.8	2.2	2.3	1.5	1.4	2.0
20	11.3	4.0	15.9	11.4	3.0	7.2	2.6	2.0	2.0	1.4	1.6	2.5
21	10.6	4.1	17.5	13.6	2.6	4.2	2.5	1.6	1.8	1.8	1.8	4.7
22	8.5	6.8	14.6	12.7	2.5	3.6	2.4	1.6	1.8	1.8	2.1	8.0
23	5.8	7.6	10.4	10.5	2.3	5.5	2.4	1.6	1.6	1.6	2.1	7.6
24	4.0	6.0	7.2	8.6	2.9	14.2	2.4	1.9	1.6	1.6	2.0	6.6
25	3.4	5.8	8.8	8.5	3.2	18.2	3.6	2.4	1.5	1.5	5.0	6.6
26	3.1	5.2	13.0	6.5	2.7	17.0	2.8	2.0	1.5	1.5	11.0	5.6
27	2.8	4.6	12.1	5.3	2.6	15.5	6.2	1.8	1.4	1.4	11.5	4.0
28	2.6	4.0	8.9	4.8	2.5	15.6	6.8	1.6	1.4	2.2	8.6	3.6
29	2.4	.....	5.8	4.3	2.4	14.2	6.2	1.5	1.3	2.2	7.0	3.4
30	2.1	.....	5.7	6.0	2.9	10.0	4.5	1.5	1.3	2.1	4.0	3.3
31	2.0	.....	5.3	.....	3.0	.....	4.0	1.5	.....	2.1	.....	3.2
1901.												
1	7.4	6.4	3.0	8.8	4.0	10.6	3.6	1.8	6.4	2.6	1.2	3.3
2	6.4	5.8	3.0	8.6	3.8	7.6	3.0	1.8	5.8	2.6	1.2	3.3
3	5.2	5.5	3.0	13.0	3.8	5.6	3.0	1.8	3.7	3.2	1.2	3.3
4	4.2	15.8	3.0	13.0	5.8	6.4	2.6	1.6	3.4	3.0	1.2	3.5
5	4.0	18.5	3.0	10.0	3.6	5.0	2.4	1.6	3.0	2.8	1.2	3.0
6	3.8	13.8	3.0	7.9	3.5	4.0	2.2	2.6	2.9	2.2	1.2	3.0
7	3.5	9.5	3.0	6.4	3.5	7.0	5.2	5.3	2.6	2.0	1.2	3.0
8	3.2	6.5	3.0	5.6	3.4	7.6	4.8	5.9	2.2	1.9	1.1	3.5
9	3.0	9.6	2.8	5.2	3.3	5.4	3.3	3.0	2.0	1.9	1.1	3.0
10	2.8	12.5	5.5	4.5	3.1	4.3	2.6	2.6	2.0	1.8	1.1	3.0
11	8.8	10.5	7.8	4.3	3.0	4.0	2.4	2.5	2.0	1.7	1.0	2.8
12	23.5	7.6	8.0	4.2	2.9	3.8	2.3	3.4	2.0	1.6	1.0	2.6
13	27.0	6.5	6.7	4.3	2.8	3.8	2.0	3.0	1.8	1.8	1.0	2.1
14	23.8	5.6	4.8	10.4	2.8	4.0	2.0	2.3	2.0	2.0	1.0	2.2
15	21.4	5.0	4.0	10.1	2.7	4.3	2.0	4.5	3.0	3.2	1.0	10.4
16	19.8	4.8	3.6	7.7	2.6	6.9	1.9	7.2	2.4	2.6	1.0	12.6
17	17.4	4.2	3.2	5.8	2.6	6.0	1.7	10.5	6.0	2.4	1.0	14.7
18	8.9	4.2	3.0	5.2	2.5	5.0	5.5	9.8	11.2	2.4	1.0	14.0
19	5.0	4.2	3.0	9.0	2.5	4.8	3.0	10.8	11.1	2.0	1.0	13.0
20	4.0	4.0	3.0	18.6	3.0	4.0	3.0	12.5	7.0	1.8	1.0	5.6
21	3.8	3.8	3.0	17.2	10.0	3.8	2.4	10.8	3.9	1.8	1.6	3.8
22	3.8	3.7	3.0	15.5	23.6	3.6	2.4	14.5	3.7	1.6	1.2	2.0
23	3.8	3.6	3.0	14.6	26.4	3.6	2.4	20.8	3.3	1.6	1.4	2.0
24	3.8	3.6	3.6	12.7	21.8	3.6	2.0	23.2	2.8	1.6	1.4	3.6
25	6.7	3.5	3.6	6.8	18.9	2.7	2.0	18.3	2.6	1.6	1.3	4.0
26	6.6	3.2	22.0	5.6	16.5	2.7	1.9	13.1	2.5	1.4	1.3	3.7
27	5.4	3.2	27.0	4.8	11.1	3.2	1.7	6.6	2.3	1.3	1.3	3.7
28	5.2	3.0	24.5	4.4	5.5	3.0	2.8	8.8	2.0	1.3	1.3	6.0
29	5.0	.....	21.3	4.2	4.9	3.6	1.9	7.5	2.0	1.3	1.3	11.7
30	4.6	.....	19.2	4.1	4.7	3.6	1.9	6.2	2.5	1.3	1.8	20.5
31	6.8	.....	16.1	.....	5.4	.....	1.6	5.6	.....	1.2	.....	22.4
1902.												
1	28.0	11.8	28.5	21.3	2.9	1.8	1.0	1.2	1.0	1.6	.2	1.9
2	24.6	22.0	27.6	14.8	2.9	1.7	1.0	1.0	.8	1.6	.2	2.0
3	21.9	24.0	24.1	7.2	3.7	1.7	1.1	.8	1.2	1.6	.2	6.2
4	17.6	20.0	21.6	5.8	3.4	1.7	1.0	.8	1.0	1.5	.2	6.6
5	6.6	15.6	19.2	5.7	3.2	1.7	.9	1.5	1.2	1.0	.2	5.4
6	5.6	9.8	14.0	5.2	3.0	1.7	.9	1.4	1.0	2.0	.4	5.0
7	4.6	6.3	10.1	6.7	2.9	1.7	1.0	1.2	.8	1.4	2.0	4.6
8	4.2	5.7	8.7	6.7	2.8	1.7	.9	1.2	.6	.9	1.6	3.7
9	4.0	5.0	7.2	7.7	2.6	2.0	.9	.6	.9	.8	1.0	2.3
10	3.9	4.6	7.0	6.6	2.6	1.9	.9	.4	1.0	.7	.8	1.9

Daily gage height, in feet, of Coosa River at Rome—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
11	3.6	4.4	6.6	5.6	2.5	1.9	0.9	0.3	0.9	2.3	0.8	1.6
12	3.5	4.0	6.0	5.0	2.4	1.8	1.4	.3	.7	2.2	.7	1.4
13	3.4	3.9	5.6	4.7	2.3	1.7	1.5	1.0	.6	2.2	.6	1.2
14	3.2	3.8	5.5	4.5	2.3	1.7	1.8	.6	2.5	2.0	.6	1.2
15	3.0	3.8	5.0	4.4	2.3	1.6	1.4	.6	1.9	1.8	.6	1.1
16	2.8	4.0	7.0	4.3	2.4	1.6	2.0	.8	1.0	1.6	.6	2.4
17	2.7	4.5	14.0	4.5	2.5	1.6	1.4	.6	.7	1.5	.6	4.3
18	2.7	4.7	11.6	5.7	2.3	1.5	1.2	.5	.4	1.3	.9	4.5
19	3.0	4.5	8.6	5.0	2.3	1.5	1.0	.4	.4	1.1	1.5	3.8
20	3.2	4.0	6.2	4.0	2.4	1.9	1.0	1.0	.4	.9	1.3	3.0
21	3.6	4.0	5.6	3.9	2.4	1.6	.9	1.3	1.0	.8	1.1	4.9
22	4.2	5.0	5.1	3.8	2.3	1.8	.8	1.0	.8	.7	1.1	5.8
23	5.0	5.6	5.0	3.7	2.3	1.5	.8	.9	.6	.6	1.0	5.8
24	4.0	5.3	4.7	3.5	2.1	1.3	.7	.7	.3	.5	.9	5.2
25	3.9	5.0	4.7	3.3	2.0	1.3	.6	.5	2.2	.4	1.6	3.8
26	3.6	5.5	4.6	3.2	2.0	1.2	.5	.5	4.0	.3	3.1	3.0
27	3.6	5.5	4.2	3.2	2.0	1.2	.5	.6	3.3	.2	4.8	2.6
28	4.2	22.7	5.0	3.0	1.8	1.1	.5	1.2	2.0	.4	3.8	2.2
29	6.5	.....	20.6	3.0	1.8	1.0	.7	1.7	2.0	.4	2.4	2.2
30	5.8	.....	28.9	2.9	1.8	1.0	2.0	1.0	1.8	.3	2.2	2.6
31	5.4	.....	26.8	.....	1.8	.....	1.6	1.0	.....	.3	.....	4.0
1903.												
1	3.0	2.8	28.6	24.9	3.6	6.0	3.0	2.8	1.0	.4	.7	.9
2	3.9	2.8	27.1	22.0	3.6	7.7	3.2	2.6	.9	.4	.7	.9
3	3.9	4.2	24.0	19.5	3.6	9.0	2.9	3.0	.9	.4	.8	.8
4	5.0	8.4	22.3	14.6	3.5	7.5	2.7	3.3	.9	.3	1.5	.7
5	4.3	13.2	20.5	8.0	3.5	11.7	2.6	3.2	.8	.3	1.5	.7
6	4.0	13.4	15.4	7.0	3.3	17.1	2.6	6.2	.7	.3	2.0	.7
7	3.7	9.7	9.9	6.4	3.4	11.7	2.6	4.6	.7	.2	2.0	.7
8	3.0	18.7	7.7	7.7	3.5	6.9	2.4	3.6	.6	.5	1.6	.7
9	2.8	21.6	6.6	10.5	3.5	5.3	2.6	3.4	.6	1.4	1.4	.7
10	2.4	16.5	10.5	8.4	3.4	4.4	2.6	3.0	.6	1.6	1.3	.7
11	3.0	15.1	11.6	6.7	3.3	4.3	2.5	2.6	.6	1.5	1.2	.7
12	5.0	21.8	16.0	6.3	3.3	6.0	2.9	2.2	.6	1.4	1.2	.6
13	5.0	19.6	14.0	5.6	3.0	4.6	5.9	2.0	.6	1.3	1.2	.6
14	4.8	14.5	10.1	14.3	3.0	4.2	11.1	2.0	.6	1.1	1.2	.6
15	3.9	11.1	9.4	13.0	3.1	4.0	6.7	1.6	.6	.9	1.0	.6
16	2.5	8.7	7.8	9.5	3.3	3.8	3.7	4.3	.9	.8	1.0	.6
17	2.4	24.7	6.8	7.4	3.0	3.4	3.5	3.2	1.7	1.2	1.0	.6
18	2.4	28.7	6.3	6.2	3.0	3.0	3.3	2.8	2.0	1.3	1.0	.6
19	2.4	25.5	5.7	5.3	2.8	2.4	3.0	2.2	1.5	1.2	1.5	.6
20	2.4	21.0	5.3	5.7	2.5	2.7	2.9	2.1	1.2	1.0	1.4	.6
21	2.2	15.2	11.0	5.8	2.5	2.5	2.5	2.0	.9	.8	1.3	.7
22	2.0	7.1	11.6	5.5	2.6	2.4	2.4	2.0	.8	.8	1.2	1.3
23	2.0	5.8	16.9	4.9	2.6	2.2	3.0	1.9	.7	.7	1.1	1.3
24	2.0	5.1	22.6	4.7	2.5	2.2	3.0	1.8	.5	.7	1.0	1.0
25	2.0	4.8	20.6	4.4	2.5	2.2	2.6	1.6	.5	.7	1.0	.9
26	2.0	4.5	16.0	4.9	2.3	2.2	2.4	1.5	.5	.6	1.0	.9
27	2.0	4.0	9.7	4.7	2.1	2.4	2.1	1.4	.5	.6	1.0	.9
28	2.4	23.1	6.9	4.0	2.0	6.8	2.0	1.4	.5	.5	.9	.9
29	3.2	.....	7.8	3.9	2.0	6.8	1.8	1.3	.4	.4	.9	.9
30	4.2	.....	22.5	3.7	2.4	4.0	2.3	1.3	.4	.4	.9	.9
31	3.8	.....	27.8	.....	6.7	.....	2.6	1.2	.....	.7	.....	.9

Rating tables for Coosa River at Rome.

JANUARY 1, 1897, TO DECEMBER 31, 1898.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−0.40	900	1.70	2,690	3.80	5,910	7.80	13,710
− .30	935	1.80	2,810	3.90	6,105	8.00	14,100
− .20	970	1.90	2,930	4.00	6,300	8.50	15,075
− .10	1,010	2.00	3,060	4.20	6,690	9.00	16,050
.00	1,070	2.10	3,190	4.40	7,080	10.00	18,000
.10	1,140	2.20	3,320	4.60	7,470	11.00	19,950
.20	1,210	2.30	3,460	4.80	7,860	12.00	21,900
.30	1,280	2.40	3,610	5.00	8,250	13.00	23,850
.40	1,360	2.50	3,760	5.20	8,640	14.00	25,800
.50	1,440	2.60	3,910	5.40	9,030	15.00	27,750
.60	1,520	2.70	4,060	5.60	9,420	16.00	29,700
.70	1,610	2.80	4,220	5.80	9,810	17.00	31,650
.80	1,700	2.90	4,380	6.00	10,200	18.00	33,600
.90	1,800	3.00	4,540	6.20	10,590	19.00	35,550
1.00	1,900	3.10	4,700	6.40	10,980	20.00	37,500
1.10	2,000	3.20	4,860	6.60	11,370	21.00	39,450
1.20	2,110	3.30	5,020	6.80	11,760	22.00	41,400
1.30	2,220	3.40	5,180	7.00	12,150	23.00	43,350
1.40	2,330	3.50	5,340	7.20	12,540	24.00	45,300
1.50	2,450	3.60	5,520	7.40	12,930		
1.60	2,570	3.70	5,715	7.60	13,320		

JANUARY 1 TO DECEMBER 31, 1899.[b]

0.30	1,470	2.50	3,000	4.70	8,107	10.00	18,760
.40	1,550	2.60	4,060	4.80	8,308	11.00	20,770
.50	1,630	2.70	4,220	4.90	8,509	12.00	22,780
.60	1,710	2.80	4,380	5.00	8,710	13.00	24,790
.70	1,790	2.90	4,540	5.20	9,112	14.00	26,800
.80	1,870	3.00	4,700	5.40	9,514	15.00	28,810
.90	1,950	3.10	4,900	5.60	9,916	16.00	30,820
1.00	2,030	3.20	5,100	5.80	10,318	17.00	32,830
1.10	2,124	3.30	5,300	6.00	10,720	18.00	34,840
1.20	2,218	3.40	5,500	6.20	11,122	19.00	36,850
1.30	2,312	3.50	5,700	6.40	11,524	20.00	38,860
1.40	2,406	3.60	5,900	6.60	11,926	21.00	40,870
1.50	2,500	3.70	6,100	6.80	12,328	22.00	42,880
1.60	2,620	3.80	6,300	7.00	12,730	23.00	44,890
1.70	2,740	3.90	6,500	7.20	13,132	24.00	46,900
1.80	2,860	4.00	6,700	7.40	13,534	25.00	48,910
1.90	2,980	4.10	6,901	7.60	13,936	26.00	50,920
2.00	3,100	4.20	7,102	7.80	14,338	27.00	52,930
2.10	3,260	4.30	7,303	8.00	14,740	28.00	54,940
2.20	3,420	4.40	7,504	8.50	15,745	29.00	56,950
2.30	3,580	4.50	7,705	9.00	16,750	30.00	58,960
2.40	3,740	4.60	7,906	9.50	17,755		

JANUARY 1, 1900, TO DECEMBER 31, 1901.[c]

0.80	1,930	1.70	2,985	2.60	4,300	3.50	5,755
.90	2,020	1.80	3,120	2.70	4,450	3.60	5,930
1.00	2,110	1.90	3,260	2.80	4,600	3.70	6,115
1.10	2,230	2.00	3,400	2.90	4,750	3.80	6,300
1.20	2,350	2.10	3,550	3.00	4,900	3.90	6,500
1.30	2,475	2.20	3,700	3.10	5,065	4.00	6,700
1.40	2,600	2.30	3,850	3.20	5,230		
1.50	2,725	2.40	4,000	3.30	5,405		
1.60	2,850	2.50	4,150	3.40	5,580		

JANUARY 1 TO DECEMBER 31, 1902.[d]

0.20	1,410	0.50	1,635	0.70	1,810	0.90	2,005
.30	1,480	.60	1,720	.80	1,905	1.00	2,110
.40	1,555						

[a] Above gage height 4.00 feet the rating curve is a tangent, the difference being 195 per tenth.
[b] Above gage height 4.00 feet the rating curve is a tangent, the difference being 201 per tenth.
[c] Above gage height 4.00 feet this table is the same as the 1899 table.
[d] Above gage height 1.00 foot this table is the same as the 1901 table.

Rating tables for Coosa River at Rome—Continued.

JANUARY 1 TO DECEMBER 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	1,280	1.20	2,530	2.20	3,910	3.40	5,725
.30	1,390	1.30	2,660	2.30	4,055	3.60	6,055
.40	1,510	1.40	2,790	2.40	4,200	3.80	6,400
.50	1,630	1.50	2,920	2.50	4,345	4.00	6,760
.60	1,750	1.60	3,060	2.60	4,495	4.20	7,140
.70	1,880	1.70	3,200	2.70	4,645	4.40	7,520
.80	2,010	1.80	3,340	2.80	4,795	4.60	7,910
.90	2,140	1.90	3,480	2.90	4,945	4.80	8,310
1.00	2,270	2.00	3,620	3.00	5,095	5.00	8,710
1.10	2,400	2.10	3,765	3.20	5,405		

[a] Above gage height 5.00 feet this table is the same as the 1899 table.

Estimated monthly discharge of Coosa River at Rome.

[Drainage area, 4,006 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1897.					
January	17,025	1,800	4,820	1.20	1.38
February	20,925	4,220	10,100	2.52	2.62
March	44,910	4,700	22,537	5.63	6.49
April	35,150	48,600	12,304	3.07	3.43
May	8,250	2,930	4,421	1.10	1.27
June	4,540	1,900	2,884	.72	.80
July	23,460	1,800	5,184	1.30	1.50
August	4,860	1,360	2,256	.56	.64
September	1,900	900	1,106	.28	.31
October	2,570	1,010	1,518	.38	.44
November	2,000	1,440	1,626	.41	.46
December	9,810	1,900	4,086	1.02	1.18
The year	44,910	900	6,070	1.52	20.52
1898.					
January	26,970	22,200	7,272	1.82	2.10
February	5,520	2,110	2,705	.68	.71
March	20,730	2,110	4,384	1.10	1.27
April	32,040	4,540	9,430	2.36	2.63
May	4,220	2,330	2,778	.69	.79
June	5,520	2,110	2,866	.72	.80
July	6,690	1,900	3,670	9.17	10.59
August	17,805	2,930	6,079	1.52	1.75
September	45,885	3,060	12,114	3.03	2.26
October	44,910	3,060	11,830	2.96	3.41
November	12,150	3,060	5,213	1.30	1.45
December	8,250	3,610	4,996	1.25	1.44
The year	45,885	1,900	6,111	2.22	29.20
1899.					
January	10,519	4,060	6,092	1.52	1.75
February	54,538	8,710	22,536	5.62	5.85
March	57,352	7,705	26,314	6.57	7.57
April	28,810	6,700	13,333	3.33	3.72
May	6,700	3,100	4,783	1.19	1.37
June	6,700	2,740	3,489	.87	9.97
July	24,388	1,950	5,499	1.37	1.58
August	3,900	1,790	2,596	.65	.75
September	5,500	1,550	2,219	.55	.61
October	2,030	1,470	1,684	.42	.48
November	4,700	1,470	2,009	.50	.56
December	13,735	1,870	4,314	1.08	1.25
The year	57,352	1,470	7,906	1.97	26.46

Estimated monthly discharge of Coosa River at Rome—Continued.

Month.	Discharge in second-feet.			Run-off. Sec.-ft. per sq. mile.	Depth in inches.
	Maximum.	Minimum.	Mean.		
1900.					
January	21,373	2,725	6,854	1.	
February	53,332	2,850	14,736	3.6	
March	33,835	6,300	14,714	3.6	
April	25,996	5,755	12,050	3.01	
May	11,122	3,850	5,129	1.28	
June	35,242	4,000	14,154	3.53	
July	19,765	4,000	7,589	1.89	
August	5,580	2,725	3,488	.87	
September	20,971	1,930	3,960	.99	
October	10,519	2,010	3,408	.85	
November	21,775	2,600	5,438	1.36	
December	14,740	3,400	7,096	1.77	
The year	53,332	1,930	8,218	2.05	
1901.					
January	52,930	4,600	15,450	3.86	
February	35,845	4,900	12,186	3.04	
March	52,930	4,600	13,406	3.34	
April	36,046	6,901	15,578	3.88	
May	51,724	4,150	12,533	3.12	
June	19,966	4,450	8,316	2.08	
July	9,715	2,850	4,441	1.10	
August	45,292	2,850	13,780	3.44	
September	21,172	3,120	6,389	1.59	
October	5,230	2,350	3,414	.85	
November	2,850	2,110	2,316	.58	
December	64,186	2,475	13,428	3.35	
The year	64,186	2,110	10,103	2.52	
1902.					
January	54,940	4,450	11,816	2.95	
February	46,900	6,300	14,812	3.70	
March	56,749	7,102	21,957	5.48	
April	41,473	4,750	10,015	2.50	
May	6,115	3,120	4,089	1.02	
June	3,400	2,110	2,836	.71	
July	3,400	1,635	2,214	.55	
August	2,985	1,480	1,998	.50	
September	6,700	1,480	2,505	.63	
October	3,850	1,410	2,346	.59	
November	8,308	1,410	2,572	.64	
December	12,328	2,225	5,885	1.47	
The year	56,749	1,410	6,920	1.73	
1903.					
January	8,710	3,620	5,442	1.36	
February	56,347	4,795	25,376	6.34	
March	56,146	9,313	27,111	6.78	
April	48,709	6,225	15,788	3.95	
May	12,127	3,620	5,278	1.32	
June	35,033	3,910	9,594	2.40	
July	20,971	3,340	5,616	1.40	
August	11,122	2,530	4,472	1.12	
September	3,620	1,510	2,002	.50	
October	3,060	1,280	2,002	.50	
November	3,620	1,880	2,512	.63	
December	2,060	1,750	1,985	.50	
The year	56,347	1,280	8,932	2.23	

OOSTANAULA RIVER AT RESACA.

This station is located at the bridge of the Western and Atlant Railway, in the town of Resaca, 800 feet south of the depot. It is United States Weather Bureau station at which the gage readings a maintained for half the year only. During the years 1896 to 18 inclusive, the United States Geological Survey maintained the gage the other half of the year, making the gage height record compl

but for other years only the half-year records of the Weather Bureau are available. No estimates of discharge were made from 1901 until the beginning of 1905, when the station was reestablished.

The channel is slightly curved, the same curve extending about 300 feet above and below the bridge. The current is moderate, becoming rather sluggish at low water. The right bank is rock at the edge of the water, and has a solid stone abutment and railroad embankment above high-water level. The left bank is low, cultivated, and overflows during high water 480 feet to the end of the trestle. The bed of the stream is composed of rock near the right bank, but other parts appear to be sandy; to the left of the pier it is nearly filled up with logs and brush. There is one channel, broken by one pier at ordinary water.

Discharge measurements are made from the downstream side of the iron bridge, which consists of three spans of 120 feet each, and 480 feet of trestle approach at the left bank. The left span of the bridge is entirely outside of the river, except at high water. Measurements are also made from a boat at the ferry about 200 feet above the bridge where the section is somewhat better. The initial point for sounding is the end of the bridge at the right bank, downstream side.

Gage heights are observed from the United States Weather Bureau gage, which is a heavy timber attached vertically to the downstream side of the center pier of the bridge. Bench marks were established as follows: (1) The top of the downstream end of the second crossbeam from the right bank; elevation, 38.94 feet. (2) A cross mark on the top of the limestone bowlder on the north side of the river, about 130 feet from the end of the railroad bridge and 40 feet west of the railroad track; elevation, 34.23 feet. Elevations refer to the datum of the gage.

Discharge measurements of Oostanaula River at Resaca.

Date.	Gage height.	Discharge.
1896.	*Feet.*	*Sec.-ft.*
July 27	2.90	1,133
August 19	1.47	492
October 13	1.70	601
1897.		
May 25	3.48	1,535
May 29	3.26	1,389
June 23	2.44	972
September 23	1.20	406
November 14	1.46	510
December 24	7.10	4,642
December 30	3.42	1,630
1898.		
May 21	2.65	1,100
July 29	5.41	2,567
August 20	3.79	1,811
August 27	4.65	2,397
1899.		
April 26	8.05	5,146
1899.		
May 20	4.15	1,67
June 9	3.10	1,17
June 21	3.05	1,08
October 14	1.75	64
1900.		
April 30	8.00	5,11
May 15	3.60	1,4
May 25	3.75	1,5
December 11	4.30	1,91
1904.		
	.95	27
September 26[a]	1.57	42
November 25[a]	1.79	38
December 21		
1905.	5.10	2,5
March 14	3.30	1,3
June 7	1.91	5
September 26		

[a] Made at different sections.

Daily gage height, in feet, of Oostanaula River at Resaca.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1896.												
1	5.5	3.9	3.7	4.8				2.1	1.2	6.5	1.5	6.25
2	4.6	3.9	3.7	11.8				2.3	1.25	3.7	1.4	6.7
3	4.2	4.6	3.7	11.6				2.65	1.2	2.05	1.4	4.6
4	3.8	4.8	3.6	11.7				2.4	1.25	1.65	1.35	3.95
5	3.4	4.5	3.5	6.6				2.15	1.15	1.5	1.9	3.7
6	3.0	10.7	3.4	5.4				2.0	1.15	1.4	3.15	4.1
7	2.9	16.7	3.8	5.0				1.9	1.3	1.3	2.1	3.9
8	3.3	15.5	4.2	4.9				1.8	1.1	1.3	2.0	3.9
9	4.0	15.9	3.9	4.8				1.75	1.1	1.3	2.1	3.9
10	4.0	14.1	3.6	4.3				1.75	1.05	1.2	1.85	3.7
11	3.5	9.3	3.4	4.2				1.65	1.0	1.2	1.7	3.5
12	3.4	6.9	4.5	4.0				1.65	1.0	1.2	3.0	3.1
13	3.3	5.0	4.9	3.8				1.7	1.5	1.55	13.65	2.9
14	3.1	9.1	4.0	3.7				1.6	1.25	1.65	11.35	2.8
15	3.0	9.7	3.7	3.6				1.6	1.1	1.5	11.1	4.2
16	2.9	7.8	3.6	3.6				1.7	1.05	1.45	4.25	3.9
17	3.7	6.4	6.5	3.6				1.7	1.0	1.35	3.3	3.3
18	4.0	5.7	8.4	3.5				1.7	1.0	1.3	3.0	3.0
19	3.8	5.3	6.6	3.5				1.5	.95	1.2	2.7	3.0
20	3.4	5.0	7.8	3.4				1.35	.9	1.15	2.6	2.9
21	3.2	4.7	7.1	3.3				1.3	.9	1.15	2.5	2.9
22	3.4	4.3	5.8	3.2				1.25	.85	1.2	2.35	2.9
23	5.7	4.1	5.2	3.2				1.2	1.95	1.2	2.4	2.85
24	10.8	4.0	4.9	4.2				1.5	1.55	1.35	2.35	2.85
25	11.5	4.0	5.3	3.7				3.2	1.25	1.9	2.25	2.4
26	10.0	3.9	5.0	3.3				2.8	1.2	1.6	2.2	2.3
27	6.2	3.8	4.7	3.1				1.95	1.1	1.5	2.1	2.5
28	5.2	3.7	4.4	3.4				1.7	1.1	1.4	2.15	2.5
29	4.7	3.7	4.2	3.4				1.5	1.7	1.95	3.8	2.4
30	4.3	.....	4.0	3.3				1.4	8.35	1.55	8.7	2.4
31	4.0	.....	4.6	3.1				1.3	.....	.....	.....	2.2
1897.												
1	2.2	3.8	4.6	7.3	5.4	4.25	2.6	2.45	2.3	1.0	1.35	1.85
2	2.2	13.9	4.4	11.4	5.05	3.5	2.25	2.3	1.9	1.05	2.05	1.65
3	2.2	14.0	4.2	12.4	4.6	3.5	2.2	3.0	1.9	1.05	2.3	2.0
4	2.2	13.2	4.3	12.5	4.4	3.05	2.15	2.4	1.8	.95	2.1	4.65
5	3.0	8.7	5.9	18.5	4.25	3.35	2.2	2.5	1.8	.95	1.9	5.1
6	3.05	6.2	10.5	20.3	4.1	3.15	2.55	3.15	1.6	1.05	1.75	5.7
7	2.75	7.3	18.0	19.6	4.0	3.0	6.2	4.0	1.5	1.1	1.65	4.3
8	2.5	7.6	18.8	16.3	3.95	2.9	3.6	3.45	1.45	1.05	1.55	4.1
9	2.4	7.0	19.0	10.1	3.85	3.0	2.8	2.85	1.4	1.05	1.55	2.6
10	2.3	6.0	16.2	10.4	3.85	3.15	2.8	2.5	1.4	1.05	1.55	2.35
11	2.25	5.8	10.7	8.6	3.95	2.9	3.25	3.2	1.4	1.1	1.55	2.2
12	2.25	8.6	16.5	7.6	4.9	2.75	3.3	2.75	1.4	2.05	1.5	2.2
13	2.25	9.8	21.7	6.8	5.45	2.7	2.9	2.5	1.35	3.0	1.45	2.1
14	5.45	7.7	21.7	6.4	8.45	2.6	2.65	2.15	1.3	1.8	1.45	4.15
15	7.5	6.4	24.6	6.8	8.75	2.55	2.3	2.1	1.3	1.6	1.45	3.5
16	5.1	5.7	26.0	8.2	5.7	2.6	2.15	2.1	1.3	1.45	1.4	4.6
17	4.1	5.4	25.3	7.0	4.7	2.7	3.1	2.55	1.3	1.35	1.4	3.4
18	5.4	4.7	23.8	6.2	4.4	2.9	2.9	3.0	1.4	1.2	1.45	2.9
19	5.2	4.5	21.3	5.8	4.1	2.75	3.4	2.2	1.25	1.15	1.45	2.75
20	4.4	4.5	18.9	5.5	3.95	2.6	11.8	2.1	1.2	2.15	1.4	3.35
21	9.6	5.0	18.2	5.3	3.85	2.6	7.85	2.0	1.15	2.05	1.4	6.2
22	8.7	4.6	18.4	5.1	3.8	2.45	9.0	2.2	1.15	2.0	1.4	8.45
23	6.1	11.4	17.5	4.9	3.75	2.35	7.2	2.6	1.15	1.8	1.4	9.25
24	5.0	12.0	12.7	4.8	3.6	2.35	4.2	2.5	1.15	1.75	1.45	7.5
25	4.4	10.6	8.4	4.8	3.5	2.45	3.25	2.2	1.15	1.5	1.4	4.95
26	4.0	6.7	7.6	4.7	3.35	2.45	4.05	2.05	1.15	1.4	1.4	4.45
27	3.7	5.7	6.7	4.7	3.3	2.3	4.4	2.0	1.15	1.35	1.55	4.5
28	3.4	5.1	6.6	4.6	3.25	2.25	3.9	1.85	1.1	1.35	1.8	4.25
29	2.7	.....	6.0	4.4	3.25	3.5	3.2	1.75	1.2	1.35	1.75	3.75
30	3.1	.....	6.0	4.3	3.15	2.9	2.8	1.7	1.0	1.3	1.75	3.4
31	3.5	.....	6.0	.....	3.5	.....	2.55	1.85	.....	1.3	.....	3.2
1898.												
1	3.1	5.15	3.1	10.05	4.5	2.65	1.9	5.9	2.65	2.7	3.65	5.3
2	2.95	4.6	2.9	7.0	4.25	2.3	2.0	4.9	12.8	2.55	3.5	4.8
3	2.7	4.2	3.0	5.7	4.1	2.25	1.9	3.8	19.1	2.5	3.5	4.5
4	2.6	3.9	3.1	5.05	3.9	2.2	1.75	3.8	21.0	6.65	3.5	4.6
5	2.6	3.8	3.05	11.95	3.8	2.1	1.7	7.0	21.0	18.7	3.4	6.0

Daily gage height, in feet, of Oostanaula River at Resaca—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
	2.6	3.8	2.9	17.7	3.65	2.0	2.2	4.3	19.2	22.0	3.45	6.2
	2.8	3.8	2.75	15.1	3.55	2.0	2.5	4.1	17.1	23.3	3.8	5.4
	3.0	3.7	2.7	12.1	3.55	1.9	4.75	3.7	11.6	21.75	3.9	4.9
	2.85	3.55	2.65	9.75	3.4	1.9	2.9	3.4	7.0	16.7	3.55	4.6
	2.75	3.45	2.65	5.85	3.35	1.85	3.2	3.7	5.4	6.9	3.4	4.3
	2.7	3.4	2.65	5.45	3.2	1.85	2.9	7.15	5.0	5.65	3.7	4.2
	6.85	3.3	2.6	5.5	3.2	1.75	2.6	6.7	4.6	5.15	3.7	4.0
	6.7	3.3	2.6	5.0	3.1	2.4	2.1	5.4	4.4	4.7	3.7	4.0
	6.85	3.15	2.7	5.1	3.1	3.5	2.2	4.75	3.95	4.55	4.4	4.0
	5.85	3.1	4.1	5.5	3.05	2.8	3.4	3.85	3.8	4.3	4.15	3.7
	6.3	3.05	8.15	5.3	2.9	2.5	3.7	3.4	3.7	4.1	4.85	3.6
	6.5	2.9	9.4	5.0	2.85	2.4	2.75	4.0	3.5	4.0	4.1	3.6
	5.1	2.9	5.95	4.6	2.8	3.85	2.4	3.2	3.35	8.0	4.4	3.7
	4.7	3.0	5.35	4.45	2.75	4.0	2.1	4.3	3.2	9.5	6.75	3.7
	8.9	3.0	4.6	5.6	2.75	5.3	2.0	4.0	3.1	6.3	7.15	4.7
	10.65	3.0	4.1	5.65	2.6	5.0	1.9	3.35	3.0	5.0	6.0	5.5
	9.0	2.95	3.85	4.55	2.6	4.45	1.75	5.3	3.0	5.0	5.15	4.9
	7.3	2.9	3.6	4.2	2.5	3.9	1.9	3.5	5.35	5.85	7.8	5.0
	7.05	2.8	3.45	10.6	2.55	2.65	1.8	2.95	4.7	4.9	7.1	5.3
	8.8	2.8	3.55	9.4	3.0	2.4	2.2	2.9	4.4	4.4	5.95	4.55
	17.1	2.7	3.95	7.15	2.7	2.2	3.2	3.45	4.3	4.25	5.1	4.25
	16.0	3.0	3.5	6.5	2.5	2.2	3.4	4.65	3.0	4.4	4.8	4.1
	13.65	3.25	3.3	5.9	2.35	2.3	5.3	3.75	2.9	4.2	4.4	4.0
	8.2	.....	6.0	5.3	2.3	2.1	5.25	2.8	2.8	4.0	4.6	3.85
	6.05	.....	11.85	4.9	2.25	2.0	4.2	2.6	2.7	3.9	5.6	3.8
	5.5	.....	12.5	.....	2.25	.....	5.2	2.65	.....	3.8	.....	3.8
1899.												
	5.1	11.0	16.2	13.4	.....	.....	.....	.....	.....	.....	1.8	2.3
	5.0	8.8	9.6	10.3	.....	.....	.....	.....	.....	.....	1.7	2.5
	4.5	7.95	8.0	8.4	.....	.....	.....	.....	.....	.....	1.7	2.6
	4.2	16.0	7.4	8.1	.....	.....	.....	.....	.....	.....	1.7	2.3
	4.1	19.9	9.3	10.2	.....	.....	.....	.....	.....	.....	1.7	2.2
	4.5	21.9	10.4	9.0	.....	.....	.....	.....	.....	.....	1.7	2.1
	7.5	25.5	9.4	8.9	.....	.....	.....	.....	.....	.....	1.6	2.0
	9.35	26.5	7.5	14.3	.....	.....	.....	.....	.....	.....	1.6	2.0
	8.8	25.3	6.8	13.9	.....	.....	.....	.....	.....	.....	1.6	1.9
	6.2	22.2	6.6	12.7	.....	.....	.....	.....	.....	.....	1.6	2.0
	5.85	15.8	6.4	8.9	.....	.....	.....	.....	.....	.....	1.6	2.1
	6.0	8.2	6.1	7.8	.....	.....	.....	.....	.....	.....	1.7	5.1
	5.8	7.0	6.0	7.4	.....	.....	.....	.....	.....	.....	1.7	8.0
	5.3	6.35	8.0	7.0	.....	.....	.....	.....	.....	.....	1.7	6.4
	5.5	6.7	16.0	6.8	.....	.....	.....	.....	.....	.....	1.6	4.0
	5.15	6.7	22.0	6.5	.....	.....	.....	.....	.....	.....	1.9	3.6
	6.1	12.1	28.6	6.2	.....	.....	.....	.....	.....	.....	2.0	3.3
	6.25	11.4	27.3	6.0	.....	.....	.....	.....	.....	.....	1.8	2.8
	5.65	10.2	26.6	6.1	.....	.....	.....	.....	.....	.....	1.8	2.7
	5.1	9.55	26.2	6.0	.....	.....	.....	.....	.....	.....	1.8	3.5
	4.85	8.1	27.3	5.8	.....	.....	.....	.....	.....	.....	1.7	4.4
	4.7	8.2	25.2	5.6	.....	.....	.....	.....	.....	.....	1.7	3.6
	4.5	8.65	21.1	5.4	.....	.....	.....	.....	.....	.....	2.3	3.3
	4.55	7.7	17.0	6.4	.....	.....	.....	.....	.....	.....	2.8	8.1
	5.5	6.9	11.0	8.6	.....	.....	.....	.....	.....	.....	2.3	8.1
	5.3	6.4	9.0	8.7	.....	.....	.....	.....	.....	.....	2.7	6.0
	4.8	17.5	8.6	7.0	.....	.....	.....	.....	.....	.....	3.8	4.5
	4.55	20.2	7.9	6.3	.....	.....	.....	.....	.....	.....	3.4	3.8
	4.4	.....	11.65	5.8	.....	.....	.....	.....	.....	.....	2.8	3.7
	4.2	.....	11.4	5.5	.....	.....	.....	.....	.....	.....	2.5	3.5
	6.1	.....	11.4	.....	.....	.....	.....	.....	.....	.....	.....	3.0
1900.												
	(a)	3.1	6.0	5.8	6.8	3.3	.....	.....	.....	.....	2.8	4.5
	(a)	3.0	7.3	5.4	5.7	3.5	.....	.....	.....	.....	2.9	4.2
	(a)	3.0	6.8	5.3	5.5	4.0	.....	.....	.....	.....	3.0	4.0
	(a)	3.1	5.9	5.6	5.3	5.5	.....	.....	.....	.....	4.6	6.0
	(a)	4.3	5.4	6.3	4.8	5.0	.....	.....	.....	.....	4.5	8.6
	(a)	4.2	5.1	6.0	4.6	7.7	.....	.....	.....	.....	3.7	6.3
	2.7	3.7	6.9	5.2	4.4	7.9	.....	.....	.....	.....	3.5	8.0
	2.6	3.5	11.3	5.0	4.0	13.0	.....	.....	.....	.....	3.0	5.6
	2.4	5.6	15.5	4.8	3.9	10.8	.....	.....	.....	.....	2.9	5.0
	2.5	9.1	14.2	4.6	3.8	7.5	.....	.....	.....	.....	2.8	4.8

a Frozen.

Daily gage height, in feet, of Oostanaula River at Resaca—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
11	4.2	7.3	11.1	7.2	3.7	5.6	.....	.....	.....	.....	2.8	4.2
12	11.3	7.8	7.6	11.6	3.6	5.8	.....	.....	.....	.....	2.8	4.6
13	11.3	20.3	6.7	9.8	3.6	6.8	.....	.....	.....	.....	2.7	4.6
14	9.9	23.0	6.0	7.4	3.4	6.6	.....	.....	.....	.....	2.7	4.8
15	6.1	23.5	5.6	6.2	3.4	5.6	.....	.....	.....	.....	2.7	4.9
16	4.9	20.8	7.5	5.8	3.4	4.8	.....	.....	.....	.....	2.7	5.0
17	4.3	13.7	6.9	6.8	3.3	6.6	.....	.....	.....	.....	2.6	5.3
18	4.1	6.5	5.9	11.9	3.3	6.8	.....	.....	.....	.....	2.6	5.4
19	6.1	5.5	6.0	12.0	3.8	10.9	.....	.....	.....	.....	2.6	5.4
20	13.1	5.2	16.9	10.4	3.9	7.0	.....	.....	.....	.....	2.7	5.9
21	12.1	5.3	17.2	11.8	3.8	6.5	.....	.....	.....	.....	2.8	10.9
22	10.2	9.1	13.8	11.6	3.7	4.8	.....	.....	.....	.....	3.6	9.3
23	6.0	8.9	8.8	9.7	3.6	9.9	.....	.....	.....	.....	3.4	8.2
24	5.2	7.3	7.7	7.7	3.7	12.8	.....	.....	.....	.....	3.3	9.0
25	4.8	7.0	8.0	7.2	3.8	14.0	.....	.....	.....	.....	3.7	8.7
26	4.4	6.7	12.2	6.2	4.0	15.0	.....	.....	.....	.....	14.4	8.7
27	4.0	6.0	10.8	5.8	4.0	17.2	.....	.....	.....	.....	13.0	5.6
28	3.7	5.5	8.3	5.6	3.7	17.5	.....	.....	.....	.....	12.2	4.8
29	3.6	.....	7.2	5.5	3.6	13.0	.....	.....	.....	.....	7.6	5.4
30	3.5	.....	6.6	7.8	3.6	9.6	.....	.....	.....	.....	5.2	5.2
31	3.4	.....	6.2	.....	3.4	.....	.....	.....	.....	.....	.....	7.7

Day.	Jan.	Feb.	Mar.	Apr.	Nov.	Dec.	Day.	Jan.	Feb.	Mar.	Apr.	Nov.	Dec.
1901.							1901.						
1	9.4	8.4	4.0	8.3	.....	2.9	17	8.9	5.8	5.0	6.8	2.9	22.8
2	7.6	6.9	4.0	9.3	.....	2.8	18	6.8	5.6	4.8	6.4	2.8	20.0
3	6.0	6.4	4.0	14.2	.....	3.2	19	6.0	5.4	4.7	12.8	2.9	9.6
4	5.6	15.7	4.0	13.2	.....	4.2	20	5.8	5.4	4.7	19.8	3.3	5.2
5	5.0	16.1	4.0	11.7	.....	4.0	21	5.4	5.2	5.2	20.6	3.4	4.8
6	4.6	12.7	4.4	8.3	.....	3.5	22	5.4	5.0	5.0	20.7	3.3	4.1
7	4.0	8.4	4.5	7.6	.....	3.6	23	5.2	4.8	4.8	18.0	3.0	4.2
8	4.0	7.2	4.2	6.8	.....	3.4	24	6.0	4.8	5.2	9.6	2.9	4.1
9	4.0	12.2	4.4	6.4	.....	3.4	25	9.1	4.6	5.8	7.7	3.7	4.0
10	4.0	13.4	9.2	6.2	.....	4.0	26	7.8	4.5	21.2	6.9	3.5	3.6
11	11.6	9.0	12.0	5.7	.....	4.5	27	6.4	4.4	25.4	6.6	3.2	3.9
12	21.8	8.0	10.9	5.6	.....	4.3	28	6.8	4.3	25.8	6.2	3.1	10.2
13	25.7	7.2	8.4	5.6	3.3	3.9	29	6.4	.....	23.2	6.0	3.0	19.2
14	26.7	6.6	6.2	11.6	3.0	4.0	30	6.7	.....	17.2	5.8	2.9	23.8
15	24.0	6.4	5.6	10.6	3.1	19.7	31	9.7	.....	9.6	.....	.....	26.8
16	18.8	5.9	5.2	7.9	3.0	22.4							

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	3.6	3.4	5.4	4.0	8.2	4.2	6.0	2.6	2.0	1.9	2.2	2.1
2	3.0	3.2	5.2	4.0	5.8	4.0	5.6	2.3	3.2	1.9	2.1	2.1
3	2.6	3.0	5.0	4.0	5.0	3.8	4.4	2.0	3.6	1.95	2.1	14.1
4	3.0	3.0	4.5	3.8	5.8	3.8	3.6	1.8	2.6	2.8	2.1	13.1
5	4.0	3.2	4.2	4.2	5.6	3.6	3.2	1.6	2.8	3.1	2.1	8.6
6	3.6	6.5	4.3	4.8	5.2	3.6	3.0	1.8	2.4	2.7	2	
7	4.6	9.0	4.5	4.6	4.8	3.4	3.4	2.0	2.2	2.1	2	4.0
8	5.4	9.5	4.5	4.4	4.6	3.4	3.6	2.8	2.0	2.0	2	3.0
9	4.0	18.0	4.5	4.4	6.4	3.6	3.6	6.0	1.8	1.9	2	12.4
10	3.8	19.8	7.6	3.8	5.8	3.2	4.8	4.6	1.8	1.9	2	18.2
11	3.8	18.5	8.6	3.8	5.2	3.0	5.0	4.2	1.6	3.1	2	16.6
12	9.0	17.0	7.0	4.0	4.8	2.8	7.4	4.6	5.0	5.2	2	13.6
13	14.2	13.0	6.8	4.0	4.2	3.2	8.8	7.6	4.0	4.7	2	9.4
14	20.2	12.0	5.2	3.8	3.8	3.0	5.8	4.2	3.4	2.9	2	8.1
15	13.2	10.0	5.0	4.2	3.6	2.8	4.0	6.2	2.8	2.6	2	7.7
16	6.0	7.5	4.7	5.0	10.3	2.8	3.8	6.8	2.2	2.9	2	8.0
17	5.0	6.5	4.6	4.8	9.6	3.0	4.0	8.8	2.2	2.9	2	8.4
18	4.6	6.0	4.5	4.6	8.0	3.2	3.6	5.4	2.0	2.75	2	8.9
19	4.2	5.8	4.2	4.6	6.3	3.8	3.2	4.7	1.8	2.4	2	8.3
20	4.8	10.2	4.3	4.4	5.2	3.2	3.0	3.8	1.8	2.3	2	8.4

Daily gage height, in feet, of Oostanaula River at Resaca—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
.....	4.2	20.2	8.5	3.8	4.6	3.2	3.0	3.4	1.8	2.2	3.0	12.8
.....	4.0	22.0	9.2	4.0	4.6	4.0	3.0	2.8	1.8	2.1	2.4	12.4
.....	4.0	20.6	6.5	4.0	5.2	6.0	3.0	2.8	1.8	2.1	2.2	11.4
.....	3.5	18.6	5.5	3.8	14.0	5.0	2.8	3.0	1.8	2.0	2.2	10.0
.....	3.5	8.6	5.2	3.6	11.0	3.8	2.8	4.0	1.8	2.1	2.3	9.6
.....	3.4	7.2	4.6	3.6	8.6	3.4	2.8	3.8	1.9	2.4	2.9	7.6
.....	3.2	6.5	4.6	4.0	6.8	3.2	2.4	3.4	1.9	2.9	2.5	6.4
.....	3.2	6.0	4.4	6.6	5.4	5.2	2.4	2.8	1.85	2.7	2.3	5.6
.....	3.0	.....	4.2	6.2	5.0	4.2	4.0	2.6	1.85	2.4	2.3	6.1
.....	3.2	.....	4.2	9.2	4.6	4.2	3.0	2.4	1.85	2.4	2.5	5.9
.....	3.5	.....	4.0	.....	4.6	.....	2.8	2.2	.....	2.4	.....	5.2

Rating table for Oostanaula River at Resaca.

JANUARY 1, 1896, TO DECEMBER 31, 1897.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	304	2.60	1,025	4.40	2,340	7.40	4,890
.90	326	2.70	1,079	4.50	2,425	7.60	5,060
1.00	350	2.80	1,134	4.60	2,510	7.80	5,230
1.10	378	2.90	1,191	4.70	2,595	8.00	5,400
1.20	408	3.00	1,250	4.80	2,680	9.00	6,300
1.30	440	3.10	1,312	4.90	2,765	10.00	7,200
1.40	475	3.20	1,377	5.00	2,850	11.00	8,100
1.50	512	3.30	1,444	5.20	3,020	12.00	9,000
1.60	552	3.40	1,514	5.40	3,190	13.00	9,900
1.70	594	3.50	1,588	5.60	3,360	14.00	10,800
1.80	637	3.60	1,665	5.80	3,530	15.00	11,700
1.90	681	3.70	1,745	6.00	3,700	16.00	12,600
2.00	727	3.80	1,830	6.20	3,870	18.00	14,400
2.10	774	3.90	1,915	6.40	4.040	20.00	16,200
2.20	822	4.00	2,000	6.60	4.210	22.00	18,000
2.30	871	4.10	2,085	6.80	4,380	24.00	19,800
2.40	921	4.20	2,170	7.00	4,550	26.00	21,600
2.50	972	4.30	2,255	7.20	4,720		

JANUARY 1 TO DECEMBER 31, 1898.[b]

1.70	594	3.30	1,425	4.90	2,500	7.80	5,430
1.80	637	3.40	1,485	5.00	2,585	8.00	5,650
1.90	681	3.50	1,550	5.20	2,765	8.50	6,200
2.00	727	3.60	1,615	5.40	2,955	9.00	6,750
2.10	774	3.70	1,680	5.60	3,140	9.50	7,300
2.20	823	3.80	1,745	5.80	3,335	10.00	7,850
2.30	873	3.90	1,810	6.00	3,525	11.00	8,950
2.40	924	4.00	1,875	6.20	3,715	12.00	10,050
2.50	976	4.10	1,940	6.40	3,910	13.00	11,150
2.60	1,030	4.20	2,005	6.60	4,110	14.00	12,250
2.70	1,085	4.30	2,070	6.80	4,330	15.00	13,350
2.80	1,140	4.40	2,135	7.00	4,550	17.00	15,550
2.90	1,195	4.50	2,205	7.20	4,770	19.00	17,750
3.00	1,250	4.60	2,275	7.40	4,990	21.00	19,950
3.10	1,305	4.70	2,345	7.60	5,210	23.00	22,150
3.20	1,365	4.80	2,420				

[a] Above gage height 8.00 feet the rating curve is a tangent, the difference being 90 per tenth.
[b] Above gage height 7.00 feet the rating curve is a tangent, the difference being 110 per tenth.

Rating table for Oostanaula River at Resaca—Continued.

JANUARY 1 TO DECEMBER 31, 1899.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	600	3.40	1,275	5.40	2,690	9.00	5,990
1.70	625	3.50	1,325	5.60	2,870	9.50	6,450
1.80	650	3.60	1,380	5.80	3,050	10.00	6,911
1.90	675	3.70	1,435	6.00	3,230	10.50	7,370
2.00	705	3.80	1,490	6.20	3,414	11.00	7,830
2.10	735	3.90	1,550	6.40	3,598	11.50	8,290
2.20	770	4.00	1,610	6.60	3,782	12.00	8,750
2.30	805	4.10	1,670	6.80	3,966	13.00	9,670
2.40	840	4.20	1,730	7.00	4,150	14.00	10,590
2.50	880	4.30	1,795	7.20	4,334	15.00	11,510
2.60	920	4.40	1,860	7.40	4,518	17.00	13,350
2.70	960	4.50	1,930	7.60	4,702	19.00	15,190
2.80	1,000	4.60	2,005	7.80	4,886	21.00	17,030
2.90	1,040	4.70	2,080	8.00	5,070	23.00	18,870
3.00	1,080	4.80	2,160	8.20	5,254	25.00	20,710
3.10	1,125	4.90	2,240	8.40	5,438	27.00	22,550
3.20	1,175	5.00	2,330	8.60	5,622	29.00	24,390
3.30	1,225	5.20	2,510	8.80	5,806		

JANUARY 1, 1900, TO DECEMBER 31, 1901.[b]

2.40	840	3.20	1,220	4.00	1,700	4.70	2,150
2.50	880	3.30	1,280	4.10	1,760	4.80	2,220
2.60	920	3.40	1,340	4.20	1,820	4.90	2,290
2.70	960	3.50	1,400	4.30	1,880	5.00	2,360
2.80	1,000	3.60	1,460	4.40	1,940	5.10	2,440
2.90	1,050	3.70	1,520	4.50	2,010	5.20	2,520
3.00	1,100	3.80	1,580	4.60	2,080	5.30	2,600
3.10	1,160	3.90	1,640				

JANUARY 1 TO DECEMBER 31, 1905.[c]

1.60	455	3.20	1,275	4.70	2,250	7.40	4,320
1.70	495	3.30	1,335	4.80	2,320	7.60	4,480
1.80	540	3.40	1,395	4.90	2,390	7.80	4,640
1.90	585	3.50	1,455	5.00	2,460	8.00	4,800
2.00	630	3.60	1,520	5.20	2,600	8.20	4,980
2.10	680	3.70	1,585	5.40	2,750	8.40	5,160
2.20	730	3.80	1,650	5.60	2,900	8.60	5,340
2.30	780	3.90	1,715	5.80	3,050	8.80	5,520
2.40	830	4.00	1,780	6.00	3,200	9.00	5,700
2.50	880	4.10	1,845	6.20	3,360	9.20	5,880
2.60	935	4.20	1,910	6.40	3,520	9.40	6,060
2.70	990	4.30	1,975	6.60	3,680	9.60	6,240
2.80	1,045	4.40	2,040	6.80	3,840	9.80	6,420
2.90	1,100	4.50	2,110	7.00	4,000	10.00	6,600
3.00	1,155	4.60	2,180	7.20	4,160	11.00	7,500
3.10	1,215						

[a] Above gage height 6.00 feet the rating curve is a tangent, the difference being 92 per tenth.
[b] Above gage height 5.3 feet this table is the same as the 1899 table.
[c] Above gage height 11.00 feet the rating curve is a tangent, the difference being 100 per tenth

Estimated monthly discharge of Oostanaula River at Resaca.

[Drainage area, 1,614 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1896.[a]					
January	8,550	1,191	2,526	1.56	
February	13,230	1,745	4,555	2.82	
March	5,760	1,514	2,598	1.61	
April	8,820	1,312	2,610	1.62	
August	1,377	408	655	.41	
September	5,717	315	584	.36	
October	4,125	393	652	.40	
November	10,480	458	1,920	1.19	
December	6,525	822	1,546	.96	

[a] The estimates for 1896 have been revised on the basis of the 1897 rating curve.

Estimated monthly discharge of Oostanaula River at Resaca—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1897.					
	6,760	822	2,097	1.30	1.50
5–22	10,800	2,425	5,081	3.15	3.28
	21,600	2,170	10,740	6.65	7.67
0	16,470	2,255	5,933	3.68	4.11
	6,040	1,344	2,340	1.45	1.67
	2,212	846	1,198	.74	.83
	8,600	798	2,004	1.24	1.43
	2,000	594	969	.60	.69
r	871	350	479	.30	.33
	1,250	338	506	.31	.36
r	871	475	551	.34	.38
	6,460	575	2,233	1.38	1.59
year	21,600	338	2,844	1.76	23.84
1898.					
	15,660	1,030	4,262	2.64	3.04
	2,720	1,085	1,487	.92	.96
	10,600	1,030	2,449	1.52	1.75
	16,320	2,170	4,909	3.04	3.39
	2,205	848	1,311	.81	.94
	2,860	616	1,124	.69	.78
	2,860	594	1,203	.74	.86
	4,715	1,030	2,084	1.29	1.49
r	19,950	1,058	5,169	3.20	3.57
	22,150	976	5,362	3.32	3.83
r	5,430	1,485	2,435	1.51	1.68
	4,110	1,615	2,258	1.40	1.61
year	22,150	594	2,838	1.76	23.89
1899.					
	6,312	1,670	2,777	1.72	1.98
	22,090	3,552	9,627	5.96	6.21
	24,022	3,230	10,416	6.45	7.44
	10,866	2,690	5,163	3.20	3.57
	1,490	600	735	.46	.52
	5,162	675	1,683	1.04	1.20
1900.					
to 31	9,762	840	3,362	2.08	1.93
	19,330	1,100	5,470	3.39	3.53
	13,534	2,430	5,760	3.57	4.11
	8,750	2,080	4,530	2.81	3.13
	3,966	1,280	1,760	1.09	1.26
	13,810	1,280	5,583	3.46	3.86
	10,958	920	2,207	1.37	1.53
	7,738	1,340	3,059	1.90	2.19
1901.					
	22,274	1,700	6,222	3.86	4.45
	12,522	1,880	4,655	2.88	3.00
	21,446	1,700	5,597	3.47	4.00
	16,846	2,870	6,699	4.15	4.63
13–30	1,640	1,000	1,211	.75	.50
	22,182	1,000	5,958	3.69	4.25
1905.					
	16,700	935	2,876	1.78	2.05
	18,500	1,155	7,512	4.65	4.84
	5,880	1,780	2,756	1.71	1.97
	5,880	1,520	2,123	1.32	1.47
	10,500	1,520	3,476	2.15	2.48
	3,200	1,045	1,572	.974	1.09
	5,520	830	1,793	1.11	1.28
	5,520	455	1,735	1.07	1.23
r	2,460	455	818	.507	.566
	2,600	585	922	.571	.658
	1,155	630	752	.466	.520
	14,700	830	5,409	3.35	3.86
year	18,500	455	2,645	1.64	22.01

COOSAWATTEE RIVER AT CARTERS.

river, which is formed by the junction of Ellijay and Cartecay
at Ellijay, flows in a southwesterly direction, joining the Cona-
to form the Oostanaula. Its drainage area is for the most part

mountainous and covered with forest growth. The gaging station established August 15 1896, by M. R. Hall, at the iron highway bi at Carters, Murray County, Ga. Carters is at the head of naviga small boats running to Rome, Ga., and the Coosa River below. at the foot of the great shoals made by this stream in cutting thr the Cohutta Mountains. The channel is curved for 1,000 feet a and 500 feet below the station. The current is swift and broken. banks are high, but overflow at flood stages. The bed of the stre of gravel and is not liable to change. Discharge measurement made from the single-span highway bridge and its approaches. initial point for soundings is the land side of the pier on the right l

A standard chain gage is attached to the downstream side o bridge in the third panel from the right bank; length of chain, feet. The observer is R. P. Messer, who reads the gage once a Bench marks were established as follows: (1) The top of the cylin iron pier at the right bank, downstream side; elevation, 30.35 (2) The top of a stone post set into the ground on the north side o river, about 300 feet from the end of the iron bridge and on the side of the road leading toward Carter's mill; elevation, 22.15 Elevations refer to the datum of the gage.

Discharge measurements of Coosawattee River at Carters.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
1896.		
August 15	0.90	320
August 17	.95	319
October 10	.55	228
1897.		
May 22	2.10	815
May 24	1.95	771
May 26	1.88	712
May 28	1.85	698
June 1	1.90	723
June 28	1.33	474
July 15	1.50	544
July 22	2.41	1,079
September 17	.70	251
September 27	.60	216
November 15	.77	243
November 24	.75	263
December 14	2.71	1,117
December 22	3.54	1,661
1898.		
January 26	5.70	3,052
March 18	1.80	697
March 30	5.87	3,079
March 30	5.35	2,782
May 28	1.36	495
June 25	1.12	385
July 28	2.55	1,019
August 25	1.77	686
November 22	4.05	2,006
1899.		
January 28	2.14	868
March 14	8.95	5,240
March 14	7.70	4,682
May 26	2.35	906
June 22	1.75	653
October 19	1.10	377
1900.		
April 28	2.60	1,075
May 11	2.15	811

Date.	Gage height.	c
	Feet.	s
1900.		
May 24	2.05	
August 13	1.58	
September 7	1.25	
November 17	1.37	
November 26	4.08	
December 22	2.70	
1901.		
April 20	7.00	
June 21	2.92	
October 25	1.95	
1902.		
April 28	2.72	
August 8	.95	
November 4	.85	
December 30	2.30	
1903.		
March 18	3.56	1
July 22	2.35	
September 8	1.22	
September 8	1.22	
October 16	1.07	
December 31	1.26	
1904.		
March 15	2.40	1.
May 26	1.30	
June 25	.99	
August 23	.85	
September 27	.50	
December 21	.82	
December 21	.73	
1905.		
March 18	2.10	
March 28	2.21	
June 6	1.77	
September 28	1.02	
December 30	2.39	
December 30	2.39	

Daily gage height, in feet, of Coosawattee River at Carters.

ay.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
96.						1896.					
.....	.....	0.75	1.25	0.8	2.5	17.....	0.95	0.5	0.65	0.95	2.35
.....	.....	.75	1.1	.85	2.25	18.....	.9	.5	.6	.9	2.2
.....	.....	.75	1.0	1.0	2.0	19.....	.85	.45	.6	.9	2.05
.....	.....	.7	.95	1.05	2.0	20.....	.8	.5	.55	.9	2.0
.....	.....	.7	.95	3.1	1.9	21.....	.8	.5	.55	.85	1.85
.....	.....	.65	.9	1.25	1.8	22.....	.8	.55	.6	.85	1.85
.....	.....	.65	.8	1.0	1.8	23.....	.75	.65	.8	.85	1.8
.....	.....	.6	.7	1.0	1.75	24.....	.95	.75	1.3	.9	1.7
.....	.....	.6	.6	.9	1.65	25.....	.95	.65	.95	1.0	1.6
.....	.....	.65	.5	.9	1.6	26.....	.95	.6	.6	1.0	1.5
.....	.....	.7	.5	6.05	1.5	27.....	.9	.6	.6	.95	1.5
.....	.....	.65	.8	3.5	1.4	28.....	.9	.55	.7	1.25	1.45
.....	.....	.6	.9	2.6	1.4	29.....	.85	1.6	1.25	1.25	1.4
.....	.....	.55	.8	1.4	1.35	30.....	.85	1.4	.9	3.5	1.4
.....	.....	.55	.75	1.0	2.5	31.....	.8	.....	.8	.....	1.35
.....	.....	.55	.7	.9	2.5						

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1897.												
.....	1.3	1.4	2.05	4.05	4.0	1.9	1.4	1.35	1.0	0.6	0.8	0.75
.....	1.25	4.0	1.95	4.1	3.25	1.9	1.4	1.35	1.0	.6	.8	.75
.....	1.25	3.0	1.85	5.0	2.75	1.9	1.3	1.3	.95	.6	1.5	.9
.....	1.25	2.15	1.85	9.0	2.5	2.2	1.3	1.3	.95	.6	1.0	2.2
.....	1.2	2.4	1.8	15.0	2.4	2.0	1.3	1.4	.9	.55	.7	3.5
.....	1.2	2.4	9.0	4.5	2.35	1.9	1.4	2.5	.9	.55	.6	1.9
.....	1.2	2.5	5.1	4.0	2.3	1.8	1.7	2.0	.9	.55	.6	1.8
.....	1.2	2.55	4.0	3.5	2.2	1.8	1.6	1.8	.8	.55	.7	1.8
.....	1.15	2.55	3.5	5.5	2.15	1.7	1.6	1.6	.75	.55	.7	1.5
.....	1.15	2.5	3.5	5.0	2.2	1.6	1.6	1.6	.75	.55	.8	1.5
.....	1.15	2.5	3.6	4.5	2.5	1.6	1.7	1.5	.7	.55	.8	2.1
.....	1.2	2.7	21.15	4.3	3.5	1.6	1.5	1.4	.7	2.5	.7	1.8
.....	4.15	2.5	11.5	4.0	2.5	1.5	1.4	1.3	.7	1.1	.7	2.0
.....	2.2	2.5	13.62	3.5	2.5	1.5	1.4	1.2	.7	1.0	.7	2.7
.....	2.1	2.1	10.0	4.5	2.4	1.5	1.5	1.1	.7	1.0	.6	2.5
.....	2.1	2.1	8.0	3.5	2.3	2.7	1.5	1.1	.65	.9	.6	2.4
.....	2.2	2.05	5.5	3.3	2.3	1.8	1.5	1.1	.7	.8	.7	2.4
.....	2.0	2.0	5.0	3.25	2.3	1.6	1.7	1.1	.65	.7	.7	2.6
.....	2.0	2.0	6.0	3.2	2.2	1.5	9.9	1.05	.6	.7	.7	2.7
.....	3.15	2.0	6.0	3.1	2.2	1.5	3.5	1.05	.6	1.45	.7	2.5
.....	4.1	2.05	5.1	3.0	2.1	1.5	2.4	1.05	.6	1.4	.65	3.0
.....	2.15	2.1	5.0	3.95	2.1	1.4	3.0	1.05	.6	1.1	.65	3.1
.....	2.1	7.0	4.8	3.95	2.0	1.4	2.0	1.0	.6	.8	.65	2.9
.....	2.0	3.5	4.5	3.9	2.0	1.5	1.5	1.0	.6	.8	.7	2.8
.....	2.0	2.5	4.0	3.8	1.9	1.4	1.5	.9	.6	.7	.7	2.5
.....	1.9	2.4	3.75	3.7	1.9	1.4	1.9	.9	.6	.7	.7	2.2
.....	1.7	2.3	3.5	3.65	1.8	1.4	1.6	.8	.6	.6	.7	2.0
.....	1.5	2.2	3.35	3.6	1.8	1.4	1.5	.8	.6	.6	.7	1.8
.....	1.4	.....	3.25	3.5	1.8	2.5	1.4	.9	.6	.6	.75	1.5
.....	1.3	.....	3.1	3.5	2.5	1.5	1.4	3.5	.65	.6	.75	1.4
.....	1.2	.....	3.0	.....	2.0	.....	1.4	1.5	.....	.55	.....	1.3
898.												
.....	1.2	2.0	1.4	2.9	2.05	1.2	.95	2.0	2.0	1.4	2.05	2.5
.....	1.1	2.0	1.4	2.9	2.0	1.2	.9	2.05	13.2	1.6	2.0	2.4
.....	1.0	2.0	1.3	2.9	1.95	1.1	.9	2.0	11.5	1.75	2.0	2.0
.....	1.0	1.95	1.3	3.0	1.9	1.1	.9	2.1	7.0	20.5	2.0	1.9
.....	1.0	1.95	1.2	13.5	1.8	1.1	1.0	2.0	5.0	23.0	1.9	1.8
.....	.9	1.9	1.1	7.0	1.8	1.05	1.1	2.15	4.0	11.5	2.0	1.7
.....	.9	1.9	1.1	5.0	1.8	1.05	1.05	1.95	3.2	5.0	1.9	1.7
.....	.95	1.8	1.1	4.2	1.7	1.0	1.1	2.0	3.0	3.5	1.9	1.6
.....	.95	1.8	1.05	3.5	1.7	1.0	1.1	2.0	2.5	3.0	1.8	1.7
.....	1.1	1.8	1.0	3.0	1.6	1.05	1.0	2.25	2.2	3.9	1.7	1.5
.....	1.5	1.7	1.0	2.3	1.6	1.0	1.0	4.7	2.0	2.8	1.8	1.6
.....	2.0	1.7	1.05	2.0	1.5	1.1	1.1	3.5	1.9	2.6	1.9	1.6
.....	2.5	1.6	1.1	2.0	1.5	1.4	1.1	3.0	1.8	2.4	2.0	1.7
.....	2.0	1.6	2.0	1.9	1.45	1.6	1.3	2.5	1.5	2.3	2.1	1.7
.....	1.8	1.6	1.9	2.05	1.45	1.7	1.4	2.25	1.4	2.3	2.05	1.6

Daily gage height, in feet, of Coosawattee River at Carters—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	De
1898.												
16	1.8	1.55	1.8	2.1	1.4	1.6	1.1	2.1	1.3	2.2	2.0	1
17	1.7	1.55	1.8	2.1	1.4	1.6	1.2	2.5	1.2	2.2	1.9	1
18	1.7	1.5	1.7	2.1	1.4	1.5	1.1	3.0	1.25	4.7	1.9	1
19	3.05	1.5	1.7	2.05	1.3	1.8	1.1	2.5	1.3	3.2	2.0	1
20	2.3	1.5	1.6	2.1	1.3	2.0	1.05	2.3	1.3	3.0	1.9	1
21	2.1	1.45	1.6	2.05	1.3	1.8	1.0	9.5	1.2	2.5	1.8	1
22	2.5	1.3	1.5	2.0	1.35	1.7	1.0	3.0	1.2	2.5	2.5	2
23	2.5	1.3	1.4	2.5	1.35	1.4	1.1	2.0	1.25	2.5	2.4	2
24	2.1	1.2	1.4	3.5	1.4	1.2	1.1	1.6	1.3	2.5	2.4	2
25	8.0	1.2	1.6	4.0	1.6	1.05	1.2	1.8	1.2	2.4	2.3	2
26	6.1	1.2	1.6	3.0	1.5	1.0	1.3	1.6	1.2	2.4	2.3	1
27	3.5	1.5	1.5	2.2	1.5	1.0	1.5	1.5	1.2	2.3	2.4	1
28	2.8	1.5	1.5	2.2	1.5	1.05	3.5	1.5	1.2	2.3	2.5	1
29	2.5	.....	3.5	2.1	1.4	.9	2.5	1.5	1.3	2.2	2.8	1
30	2.5	.....	6.5	2.1	1.3	.95	2.0	1.6	1.3	2.1	2.7	1
31	2.1	.....	4.0	.....	1.25	.....	3.0	1.7	.....	2.1	.....	1
1899.												
1	1.8	2.5	5.0	5.1	3.4	2.0	1.4	1.9	1.0	.75	.95	.8
2	1.9	3.0	4.5	5.0	3.3	1.95	1.5	1.8	1.05	.75	.9	1
3	1.9	3.5	3.5	5.2	3.2	1.95	1.4	1.8	1.0	.7	.9	1
4	2.0	15.8	3.5	6.0	3.0	1.9	1.4	1.7	1.0	.65	.9	1
5	2.05	14.0	6.1	5.8	2.9	2.0	1.45	1.6	.95	.65	.85	1
6	2.1	13.2	4.8	5.5	2.9	2.0	1.4	1.5	1.0	.7	.85	1
7	2.0	12.5	4.5	5.5	2.8	1.9	1.3	1.45	.95	.7	.8	1
8	3.0	8.0	4.0	4.8	2.7	1.9	1.3	1.5	.9	1.5	.8	1
9	2.0	6.0	3.2	4.0	2.65	1.85	1.6	1.5	.9	1.2	.9	
10	2.0	6.0	3.0	3.7	2.6	1.85	1.5	1.4	.9	1.0	.8	
11	2.1	5.0	3.5	3.6	2.5	1.9	1.5	1.4	.95	.9	.8	1
12	2.0	4.0	3.5	3.5	2.5	3.2	1.4	1.3	.9	.9	.9	2
13	1.9	4.0	4.0	3.4	2.6	3.0	1.4	1.3	.9	.95	.9	2
14	1.9	4.5	4.5	3.0	2.6	2.5	1.4	1.6	.9	.9	1.0	2
15	2.0	4.5	19.0	3.0	2.5	2.3	1.35	1.5	.85	.9	.9	2
16	2.2	4.0	12.0	3.1	2.5	2.2	1.3	1.4	.85	.9	.9	1
17	2.8	5.0	10.0	4.0	2.4	2.1	1.7	1.2	.85	.9	1.0	1
18	2.6	4.7	9.0	4.0	2.3	2.0	1.5	1.2	.8	.85	1.05	1
19	2.4	3.6	7.5	3.75	2.3	1.9	1.6	1.15	.85	.85	1.0	1
20	2.3	3.5	6.0	3.5	2.2	1.9	1.8	1.15	.85	.9	1.1	1
21	2.1	4.0	5.0	3.4	2.2	1.8	2.2	1.1	.8	.9	1.1	1
22	2.1	3.5	8.0	3.5	2.3	1.7	3.0	1.1	.8	.9	1.0	1
23	2.0	3.4	7.0	3.5	2.2	1.7	2.5	1.1	.85	.85	.9	1
24	2.0	3.5	6.5	4.0	2.15	1.7	2.0	1.05	.85	.85	1.0	1
25	2.5	4.0	5.0	6.0	2.15	1.6	2.0	1.05	.8	.8	1.0	2
26	2.3	5.0	5.0	5.0	2.1	1.6	3.2	1.1	.8	.8	1.2	
27	2.1	15.0	5.2	4.0	2.1	1.5	3.0	1.1	.8	.75	1.1	1
28	2.1	7.0	4.8	4.0	2.05	1.5	3.0	1.05	.8	.8	1.05	1
29	2.1	.....	4.5	3.7	2.05	1.4	2.2	1.15	.75	1.0	1.0	1
30	2.2	.....	4.6	3.6	2.0	1.45	1.9	1.2	.8	1.0	1.0	1
31	2.4	.....	4.4	.....	2.0	.....	2.0	1.1	.....	.9	.....	
1900.												
1	1.2	1.4	3.0	2.4	2.7	1.9	3.5	2.0	.....	.....	.....	1
2	1.2	1.4	3.1	2.4	2.6	2.0	3.5	2.0	.....	.....	.....	1
3	1.1	1.3	2.7	2.5	2.5	2.0	5.0	1.9	.....	.....	.....	1
4	1.1	1.4	2.8	2.6	2.4	2.0	4.8	1.9	.....	.....	1.5	1
5	1.0	1.5	4.75	2.5	2.3	2.1	4.0	1.8	.....	.....	1.4	1
6	1.0	1.7	4.75	2.6	2.2	2.2	3.8	1.7	.....	.....	1.5	1
7	1.1	1.8	4.9	2.6	2.2	5.0	3.6	1.7	.....	.....	1.5	1
8	1.1	2.0	5.2	2.5	2.1	3.0	3.5	1.7	.....	.....	1.6	1
9	1.2	4.1	5.0	2.6	2.4	5.0	3.4	1.6	.....	.....	1.6	1
10	4.0	2.5	4.6	2.7	2.2	4.5	3.5	1.6	.....	.....	1.5	1
11	4.3	2.5	3.1	4.0	2.0	3.0	3.4	1.6	.....	.....	1.5	1
12	7.0	8.5	2.9	5.0	1.9	2.2	3.3	1.6	.....	.....	1.4	1
13	3.5	20.5	3.0	3.0	1.7	2.0	3.0	1.5	.....	.....	1.4	1
14	2.0	5.4	2.9	2.5	1.7	2.4	2.8	1.5	.....	.....	1.3	1
15	1.9	4.0	2.8	2.6	1.8	2.6	2.6	1.4	.....	.....	1.3	1
16	1.7	3.2	2.5	2.7	1.8	3.0	2.6	1.4	.....	.....	1.3	1
17	1.7	2.8	2.5	2.8	2.1	3.0	2.4	1.5	.....	.....	1.4	1
18	2.0	2.7	3.0	3.0	2.0	3.4	2.2	1.5	.....	.....	1.4	2
19	4.3	2.5	7.5	3.5	1.9	5.0	2.0	1.5	.....	.....	1.4	4
20	4.0	2.2	4.0	3.7	1.8	5.6	2.0	1.6	.....	.....	1.3	4

Daily gage height, in feet, of Coosawattee River at Carters—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1900.												
	2.5	3.0	3.5	4.5	1.7	4.2	2.0	1.6	.....	.....	1.3	3.2
	2.2	3.2	3.0	3.5	1.7	4.7	1.9	1.8	.....	.....	1.4	2.6
	2.0	3.1	2.9	3.0	1.8	4.5	1.8	2.0	.....	.....	1.4	2.7
	2.0	3.05	2.5	2.9	1.9	4.0	3.0	2.5	.....	.....	1.6	2.6
	1.9	3.0	2.0	2.8	2.0	5.0	2.2	1.9	.....	.....	3.5	2.5
	1.8	3.0	5.0	2.7	2.1	6.0	3.5	.....	.....	.....	5.0	2.5
	1.8	2.9	3.6	2.8	2.0	6.5	5.2	.....	.....	.....	4.0	2.4
	1.7	2.5	3.5	3.0	1.9	5.0	3.2	.....	.....	.....	2.5	2.3
	1.6	.....	3.1	3.1	1.8	4.5	2.4	.....	.....	.....	1.5	2.4
	1.5	.....	3.0	3.0	1.8	4.0	2.3	.....	.....	.....	1.5	2.5
	1.5	.....	2.8	.....	1.9	.....	2.2	.....	.....	.....	.....	2.6
1901.												
	3.1	4.0	2.3	5.0	3.0	5.0	3.3	1.7	3.7	2.6	1.8	2.0
	3.0	3.0	2.2	8.0	2.9	3.8	3.2	2.0	3.5	2.6	1.7	2.3
	2.5	6.75	2.2	6.0	2.9	3.5	3.0	2.1	3.0	2.5	1.7	2.5
	2.5	6.0	2.3	5.0	2.8	3.4	2.8	2.5	3.0	2.5	1.7	2.5
	2.4	8.5	2.2	4.5	2.8	3.3	2.8	5.0	2.7	2.4	1.8	2.6
	2.2	5.0	2.3	4.5	2.6	3.1	2.6	4.5	2.6	2.4	1.8	2.8
	2.1	4.0	2.3	4.2	2.6	3.0	3.0	3.0	2.5	2.3	1.7	2.9
	2.1	4.0	2.2	4.0	2.5	3.2	2.8	2.5	2.5	2.2	1.8	3.0
	2.05	6.5	2.1	3.9	2.5	3.2	2.6	2.0	2.4	2.2	1.9	3.1
	2.0	5.2	4.8	3.9	2.4	3.4	2.6	2.25	2.4	2.1	1.8	3.0
	16.5	5.0	3.6	3.8	2.4	3.5	2.5	2.0	2.6	2.1	1.8	2.9
	6.0	4.5	3.2	3.5	2.3	4.0	2.4	2.5	2.7	2.0	1.7	2.9
	6.0	4.0	3.0	3.5	2.4	4.5	2.5	3.0	2.5	2.0	1.7	3.0
	5.0	3.5	2.8	3.2	2.5	5.0	2.4	9.0	2.5	2.0	1.8	13.0
	4.1	3.2	2.7	4.6	2.4	5.2	2.3	4.5	3.0	1.9	1.8	9.0
	3.6	3.0	2.6	4.2	2.5	4.8	2.2	5.0	19.0	1.9	1.9	6.0
	3.2	3.0	2.5	4.0	2.5	4.0	2.0	4.5	7.0	1.8	1.8	4.5
	3.0	3.0	2.6	4.0	3.0	3.5	1.8	5.0	4.5	1.8	1.9	3.0
	3.0	2.9	2.7	12.0	3.0	3.0	1.6	5.0	4.0	1.8	1.9	2.9
	2.5	2.9	2.6	7.0	4.0	2.8	1.8	6.0	3.5	1.9	1.8	2.9
	2.5	2.8	2.5	6.0	19.5	2.6	2.0	17.0	3.5	1.9	1.8	2.8
	2.7	2.8	2.5	5.0	12.0	2.6	2.2	15.0	3.4	1.8	1.9	2.8
	2.8	2.6	2.7	4.1	8.0	2.5	2.3	10.0	3.2	1.8	1.9	2.0
	3.0	2.6	3.2	3.8	6.0	2.5	2.0	8.0	3.1	1.7	2.0	2.9
	3.0	2.5	14.65	3.7	5.0	2.4	2.0	7.0	3.0	1.7	2.0	3.0
	2.6	2.4	18.3	3.5	5.0	2.4	2.0	6.5	3.0	1.8	2.1	3.1
	2.6	2.5	9.0	3.4	4.5	2.6	1.9	6.0	2.9	1.8	2.0	5.5
	2.4	2.4	7.0	3.2	4.5	2.6	1.8	4.0	2.8	1.8	1.9	9.0
	2.4	.....	7.0	3.0	4.4	3.0	1.7	4.0	2.6	1.8	1.8	21.5
	2.5	.....	6.0	3.0	4.2	3.5	1.6	4.2	2.7	1.9	1.8	13.0
	3.5	.....	6.2	.....	4.0	.....	1.5	4.0	.....	1.9	.....	11.0
1902.												
	9.0	11.0	15.0	4.0	3.0	1.7	1.7	.9	.9	1.0	.7	2.5
	7.0	9.0	15.0	3.9	3.0	1.7	1.7	.8	.8	1.0	.7	3.0
	6.0	7.5	10.0	3.8	2.9	1.8	1.6	.9	1.0	.9	.8	5.0
	5.0	5.0	9.0	4.0	2.7	1.8	1.6	.8	.9	.9	.8	4.0
	4.0	4.0	8.0	3.8	2.5	1.8	1.6	.8	1.0	1.0	.8	3.0
	3.0	3.9	6.5	3.4	2.7	1.7	1.6	.9	.9	.9	1.0	2.0
	2.9	3.8	5.0	3.6	2.6	1.9	1.7	.9	.8	.8	2.0	1.3
	2.9	3.8	4.0	3.8	2.5	2.5	1.5	.8	1.0	.8	1.7	1.7
	2.8	3.7	3.5	3.7	2.4	2.3	1.5	.8	.9	.8	.9	1.5
	2.8	3.7	3.5	3.4	2.4	1.8	1.5	1.0	.8	.9	.9	1.4
	2.7	3.6	3.9	3.3	2.4	1.7	1.6	2.1	.8	1.4	.8	1.2
	2.7	3.6	3.8	3.3	2.3	1.7	1.5	1.8	2.0	1.0	.7	1.1
	2.8	3.5	3.7	3.3	2.3	1.6	1.5	1.5	1.5	.9	.7	1.1
	2.8	3.4	3.5	3.2	2.2	1.6	1.4	1.0	1.1	2.5	.8	1.0
	2.7	3.4	3.4	3.2	2.2	1.7	1.4	.9	.9	1.4	.8	1.0
	2.6	3.5	6.4	3.1	2.3	1.8	1.3	.9	.8	1.2	.7	3.0
	2.6	3.5	5.2	3.1	2.3	1.7	1.3	.9	.9	.9	1.6	2.0
	2.5	3.5	3.8	3.2	2.5	1.5	1.3	1.0	.8	.9	1.5	1.8
	2.6	3.6	4.7	3.0	2.3	1.5	1.2	.9	.9	.8	1.1	1.7
	2.5	3.7	4.4	2.9	2.2	1.4	1.2	.8	1.9	.8	.9	1.6
	2.4	3.8	3.4	2.9	2.4	1.4	1.2	.9	1.1	.8	.9	6.5
	2.5	4.0	3.3	2.8	2.2	1.5	1.2	1.0	.9	.9	1.0	4.0
	2.5	4.0	3.3	2.9	2.1	1.5	1.1	.9	.9	.9	1.2	2.5
	2.4	3.8	3.3	2.9	2.0	1.6	1.1	.8	1.0	.8	1.5	2.0
	2.4	3.6	3.3	2.9	1.9	1.6	1.1	.8	1.2	.8	6.5	1.7

Daily gage height, in feet, of Coosawattee River at Carters—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.											
26	2.4	3.5	3.4	2.8	2.0	1.5	1.0	0.8	2.0	0.8	4.5
27	2.5	4.0	3.5	2.8	2.0	1.4	1.0	.9	1.3	.7	4.0
28	2.5	23.0	4.2	2.8	1.9	1.4	.9	1.0	1.1	.7	3.5
29	2.6	.....	18.0	2.9	1.9	1.5	.9	1.4	.9	.8	3.0
30	2.9	.....	5.0	3.0	1.8	1.6	.9	1.1	.9	.8	2.5
31	3.5	.....	4.7	.....	1.8	.....	.9	.9	.....	.8	.....
1903.											
1	1.7	2.0	9.2	6.0	3.4	4.5	2.6	2.2	1.3	1.0	1.2
2	2.0	2.5	5.4	5.2	3.2	5.0	2.5	2.3	1.2	1.0	1.2
3	2.5	3.0	4.6	4.9	3.2	5.2	2.4	2.4	1.2	1.0	1.4
4	2.0	10.0	4.1	5.0	3.1	5.0	2.3	2.5	1.2	1.0	1.3
5	1.6	9.0	4.1	4.4	3.0	6.8	2.3	2.4	1.2	1.0	1.2
6	1.6	7.0	5.0	4.2	2.8	5.5	2.2	2.3	1.3	.9	1.2
7	1.5	8.0	3.7	4.1	2.8	4.2	2.1	2.2	1.3	.9	1.1
8	1.4	7.0	5.9	8.0	2.7	3.5	2.0	2.1	1.2	2.0	1.1
9	1.4	6.0	4.6	4.1	2.7	3.6	2.2	2.3	1.2	1.4	1.05
10	1.2	6.0	5.1	4.2	2.7	3.0	2.3	2.4	1.15	1.2	1.05
11	3.3	9.0	8.9	4.0	2.6	4.7	2.5	2.3	1.1	1.0	1.2
12	2.7	6.5	4.8	3.8	2.6	4.2	3.0	2.2	1.05	1.05	1.3
13	2.4	4.5	4.3	10.0	2.5	3.5	9.0	2.1	1.05	1.0	1.1
14	2.1	4.0	4.2	5.4	2.5	3.4	6.0	2.1	1.1	1.0	1.1
15	2.0	4.0	4.0	4.8	2.4	3.0	4.2	2.0	1.2	1.0	1.1
16	2.0	10.5	3.8	4.4	2.5	2.8	3.8	2.2	1.6	1.05	1.2
17	1.9	9.0	3.7	4.1	2.5	2.6	3.5	2.1	1.4	1.6	2.8
18	2.0	6.0	3.4	3.9	2.5	2.5	3.0	2.0	1.3	1.3	2.6
19	1.9	4.2	3.4	4.0	2.4	2.4	2.8	1.9	1.2	1.2	2.4
20	1.8	4.0	3.3	4.0	2.4	2.2	2.4	1.8	1.1	1.2	2.0
21	1.8	3.5	4.3	3.9	2.6	2.2	2.3	1.7	1.1	1.1	1.9
22	1.7	3.3	6.1	3.9	2.4	2.0	2.2	1.6	1.1	1.05	1.7
23	1.7	3.2	18.2	3.8	2.4	2.1	2.1	1.5	1.05	1.0	1.4
24	1.6	3.1	8.1	3.8	2.5	2.2	2.2	1.4	1.1	1.0	1.3
25	1.6	3.0	5.2	3.7	2.6	3.0	2.1	1.4	1.1	1.05	1.2
26	1.5	2.9	4.6	3.7	2.6	3.5	2.0	1.3	1.05	1.1	1.2
27	1.5	3.4	4.2	3.6	2.4	4.0	2.0	1.3	1.05	1.1	1.2
28	1.5	21.5	4.4	3.5	2.3	3.0	2.2	1.2	1.05	1.0	1.3
29	2.5	.....	6.4	3.6	3.0	3.0	2.1	1.2	1.05	1.0	1.2
30	2.2	.....	21.0	3.5	3.5	2.9	2.2	1.2	1.05	1.1	1.1
31	2.0	.....	7.8	.....	5.0	.....	2.4	1.3	.....	1.2	.....
1904.											
1	1.2	1.5	1.7	2.2	1.7	2.0	1.1	5.0	.8	.5	.4
2	1.1	1.5	1.7	2.2	1.7	1.8	1.0	2.0	.7	.5	.4
3	1.4	1.5	1.7	2.1	1.7	1.5	1.0	1.5	.7	.5	.4
4	1.1	1.5	3.5	2.0	2.0	1.3	1.0	1.3	.7	.45	.7
5	1.1	1.4	3.75	1.9	1.8	1.2	1.0	1.6	.9	.45	.6
6	1.1	1.3	3.0	1.9	1.7	3.1	1.4	1.2	.8	.45	.6
7	1.1	1.4	3.0	1.9	1.7	3.0	1.3	1.1	.7	.45	.5
8	1.1	2.8	2.5	4.0	4.45	2.0	1.8	1.6	.7	.45	.5
9	1.1	2.6	2.2	3.0	3.0	1.8	1.5	2.0	.6	.4	.5
10	1.1	1.8	2.1	2.5	2.0	1.6	1.2	1.5	.6	.4	.5
11	1.3	1.6	2.0	2.3	1.8	1.3	1.0	1.4	.6	.4	.4
12	1.3	1.5	1.9	2.2	1.7	1.3	2.05	1.3	.6	.4	.4
13	1.3	1.5	1.8	2.0	1.7	1.2	1.7	1.1	.5	.4	.4
14	1.3	1.4	4.8	1.9	1.7	1.2	1.2	1.0	.5	.4	.4
15	1.2	1.7	2.8	1.9	1.6	1.2	1.0	1.0	.7	.4	.4
16	1.3	1.7	2.2	1.9	1.6	1.2	1.0	1.0	.6	.4	.4
17	2.8	1.6	2.1	1.8	1.6	1.1	1.8	1.0	.6	.4	.4
18	1.9	1.6	2.0	1.8	1.6	1.1	1.3	1.0	.5	.4	.4
19	1.5	3.4	1.8	1.8	1.5	1.1	1.0	.9	.5	.4	.4
20	1.4	3.0	1.8	1.8	1.5	1.0	1.0	.9	.4	.4	.4
21	1.4	2.3	1.8	1.8	1.5	3.0	.9	.9	.4	.4	.4
22	4.35	4.8	2.0	1.8	1.5	2.0	1.8	.8	.4	.4	.5
23	3.0	3.5	5.2	1.8	1.4	1.5	1.5	.8	.5	.4	.6
24	2.3	2.4	3.8	1.7	1.4	1.2	1.0	.8	.5	.4	.6
25	2.0	2.2	2.9	1.7	1.3	1.0	1.0	.9	.5	.4	.6
26	1.7	2.1	2.8	4.0	1.3	1.0	1.0	1.0	.45	.4	.6
27	1.6	2.0	2.8	2.5	1.3	1.0	.9	.9	.5	.4	.6
28	1.5	1.8	2.6	2.0	1.2	1.2	1.1	1.0	.5	.4	.5
29	1.5	1.8	2.5	1.8	1.2	1.2	1.0	.9	.5	.4	.5
30	1.5	.....	2.4	1.7	1.2	1.8	1.0	.9	.5	.4	1.8
31	1.5	.....	2.3	.....	3.7	.....	.9	.8	.....	.4	.....

Daily gage height, in feet, of Coosawattee River at Carters—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
.....	1.3	1.4	3.0	2.4	2.5	2.0	1.9	1.5	1.4	1.0	1.1	1.1
.....	1.8	1.5	3.0	2.2	2.0	2.0	1.8	1.5	4.2	1.0	1.1	2.0
.....	1.8	1.4	2.8	2.1	2.0	1.95	1.8	1.4	3.5	1.1	1.1	18.2
.....	1.8	1.4	2.7	2.0	1.9	1.8	1.8	1.4	2.0	1.0	1.0	9.0
.....	1.7	1.4	2.6	2.0	1.9	1.8	1.9	1.35	1.6	1.0	1.0	4.0
.....	1.7	1.5	2.3	2.3	2.3	1.75	2.0	1.35	1.4	.9	1.0	3.0
.....	1.1	3.0	2.2	2.2	2.3	1.75	2.0	1.35	1.4	.9	1.0	3.0
.....	1.2	9.5	2.2	2.2	2.2	1.7	1.9	1.6	1.35	.9	1.0	12.0
.....	1.3	13.0	2.5	2.1	2.1	1.7	2.0	1.6	1.3	1.0	1.0	9.6
.....	1.2	5.0	3.0	2.1	2.0	1.8	3.0	2.0	1.3	1.0	1.0	4.5
.....	1.1	4.0	4.2	2.3	2.0	1.8	5.0	4.0	1.3	3.0	.9	2.5
.....	14.5	4.0	3.2	2.5	1.9	1.7	5.5	3.0	6.0	1.8	.9	2.5
.....	7.3	6.0	2.4	2.4	1.9	1.7	4.0	2.5	2.0	1.8	.9	2.5
.....	4.2	4.0	2.3	2.3	1.85	1.7	2.0	2.0	1.5	1.8	.9	2.5
.....	3.6	3.0	2.3	2.2	3.5	1.9	1.9	3.5	1.4	1.6	.9	2.5
.....	3.1	3.0	2.2	2.0	5.5	1.8	1.9	3.0	1.3	1.4	.9	2.3
.....	3.0	2.6	2.2	2.0	3.3	1.8	1.8	2.5	1.3	1.4	.9	2.2
.....	2.8	2.6	2.1	1.95	2.5	1.7	1.8	2.4	1.2	1.4	.9	2.2
.....	2.6	2.8	2.0	1.95	2.3	1.8	1.8	2.0	1.2	1.3	1.0	2.1
.....	2.4	14.0	2.0	1.8	2.4	1.8	1.7	2.0	1.15	1.3	1.0	2.1
.....	2.3	10.0	6.5	1.8	2.2	1.75	1.7	1.8	1.15	1.4	1.0	5.0
.....	2.0	6.0	3.5	1.85	7.0	1.9	1.7	1.8	1.1	1.4	.9	4.0
.....	1.8	4.0	3.0	1.9	4.0	1.9	1.8	1.7	1.05	1.3	.9	3.6
.....	1.6	3.5	2.6	2.0	3.5	1.8	2.0	1.7	1.0	1.3	1.1	3.2
.....	1.4	3.0	2.5	2.0	3.0	1.8	1.8	1.6	1.0	1.2	2.0	3.0
.....	1.2	3.5	2.4	1.9	2.8	1.9	1.8	1.6	1.0	1.2	2.1	2.5
.....	1.1	3.3	2.3	2.5	2.5	3.5	1.7	1.5	1.0	1.2	1.5	2.5
.....	1.2	3.2	2.2	2.1	2.3	3.0	1.7	1.4	1.0	1.2	1.1	2.4
.....	1.3	.....	2.2	2.0	2.3	2.0	1.6	1.4	1.0	1.3	1.1	2.4
.....	1.3	.....	2.5	3.5	2.2	2.0	1.6	1.4	1.0	1.3	1.1	2.4
.....	1.4	.....	2.5	.....	2.2	.....	1.5	1.4	.....	1.2	.....	2.4

Rating tables for Coosawattee River at Carters.

AUGUST 17, 1896, TO DECEMBER 31, 1897.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	158	1.90	722	3.30	1,506	5.40	2,808
.50	188	2.00	771	3.40	1,568	5.60	2,932
.60	219	2.10	821	3.50	1,630	5.80	3,056
.70	250	2.20	872	3.60	1,692	6.00	3,180
.80	284	2.30	924	3.70	1,754	7.00	3,800
.90	318	2.40	977	3.80	1,816	8.00	4,420
1.00	353	2.50	1,031	3.90	1,878	9.00	5,040
1.10	388	2.60	1,086	4.00	1,940	10.00	5,660
1.20	423	2.70	1,143	4.20	2,064	12.00	7,160
1.30	460	2.80	1,201	4.40	2,188	14.00	8,660
1.40	499	2.90	1,260	4.60	2,312	16.00	10,160
1.50	540	3.00	1,320	4.80	2,436	18.00	11,660
1.60	583	3.10	1,382	5.00	2,560	20.00	13,160
1.70	628	3.20	1,444	5.20	2,684	22.00	14,660
1 80	674						

JANUARY 1 TO DECEMBER 31, 1898.[b]

0.90	313	2.00	771	3.10	1,380	4.10	2,043
1.00	355	2.10	821	3.20	1,440	4.20	2,120
1.10	388	2.20	872	3.30	1,500	4.30	2,199
1.20	423	2.30	924	3.40	1,560	4.40	2,280
1.30	460	2.40	977	3.50	1,623	4.50	2,350
1.40	499	2.50	1,031	3.60	1,690	4.60	2,420
1.50	540	2.60	1,086	3.70	1,760	4.70	2,480
1.60	583	2.70	1,143	3.80	1,830	4.80	2,540
1.70	628	2.80	1,201	3.90	1,900	4.90	2,600
1.80	674	2.90	1,260	4.00	1,970	5.00	2,660
1.90	722	3.00	1,320				

Between gage height 3.00 and 10.00 feet the rating curve is a tangent, the difference being 62 per tenth.
[a] Above gage height 10.00 feet the rating curve is a tangent with a difference of 75 per tenth.
[b] Above gage height 5.00 feet the table is the same as that for 1899.

Rating tables for Coosawattee River at Carters—Continued.

JANUARY 1 TO DECEMBER 31, 1899.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	230	2.50	1,031	4.60	2,378	8.20	4,830
.70	250	2.60	1,086	4.80	2,514	8.40	4,962
.80	280	2.70	1,142	5.00	2,650	8.60	5,098
.90	310	2.80	1,200	5.20	2,786	8.80	5,234
1.00	345	2.90	1,258	5.40	2,922	9.00	5,370
1.10	382	3.00	1,318	5.60	3,058	9.50	5,710
1.20	420	3.10	1,378	5.80	3,194	10.00	6,050
1.30	457	3.20	1,440	6.00	3,330	10.50	6,390
1.40	495	3.30	1,503	6.20	3,466	11.00	6,730
1.50	537	3.40	1,566	6.40	3,602	11.50	7,070
1.60	580	3.50	1,632	6.60	3,738	12.00	7,410
1.70	627	3.60	1,698	6.80	3,874	13.00	8,090
1.80	675	3.70	1,766	7.00	4,010	14.00	8,770
1.90	722	3.80	1,834	7.20	4,146	15.00	9,450
2.00	770	3.90	1,902	7.40	4,282	16.00	10,130
2.10	820	4.00	1,970	7.60	4,418	17.00	10,810
2.20	872	4.20	2,106	7.80	4,554	18.00	11,490
2.30	924	4.40	2,242	8.00	4,690	19.00	12,170
2.40	977						

JANUARY 1, 1900, TO DECEMBER 31, 1901.[b]

1.00	355	3.10	1,345	5.20	2,694	9.20	5,574
1.10	390	3.20	1,400	5.40	2,838	9.40	5,718
1.20	425	3.30	1,455	5.60	2,982	9.60	5,862
1.30	460	3.40	1,510	5.80	3,126	9.80	6,006
1.40	495	3.50	1,567	6.00	3,270	10.00	6,150
1.50	535	3.60	1,625	6.20	3,414	10.50	6,510
1.60	575	3.70	1,687	6.40	3,558	11.00	6,870
1.70	622	3.80	1,750	6.60	3,702	11.50	7,230
1.80	670	3.90	1,812	6.80	3,846	12.00	7,590
1.90	717	4.00	1,875	7.00	3,990	12.50	7,950
2.00	765	4.10	1,942	7.20	4,134	13.00	8,310
2.10	815	4.20	2,010	7.40	4,278	14.00	9,030
2.20	865	4.30	2,077	7.60	4,422	15.00	9,750
2.30	917	4.40	2,145	7.80	4,566	16.00	10,470
2.40	970	4.50	2,212	8.00	4,710	17.00	11,190
2.50	1,022	4.60	2,280	8.20	4,854	18.00	11,910
2.60	1,075	4.70	2,347	8.40	4,998	19.00	12,630
2.70	1,127	4.80	2,415	8.60	5,142	20.00	13,350
2.80	1,180	4.90	2,482	8.80	5,286	22.00	14,790
2.90	1,235	5.00	2,550	9.00	5,430	24.00	16,230
3.00	1,290						

JANUARY 1, 1902, TO DECEMBER 31, 1903.[c]

0.70	250	0.90	310	1.10	382	1.30	455
.80	280	1.00	345	1.20	420	1.40	495

JANUARY 1 TO DECEMBER 31, 1904.[d]

0.40	184	1.50	512	2.60	1,058	3.60	1,620
.50	202	1.60	557	2.70	1,112	3.70	1,680
.60	222	1.70	603	2.80	1,166	3.80	1,740
.70	244	1.80	650	2.90	1,220	3.90	1,805
.80	269	1.90	698	3.00	1,275	4.00	1,870
.90	296	2.00	747	3.10	1,330	4.20	2,000
1.00	326	2.10	797	3.20	1,385	4.40	2,130
1.10	358	2.20	848	3.30	1,440	4.60	2,270
1.20	393	2.30	900	3.40	1,500	4.80	2,410
1.30	430	2.40	952	3.50	1,560	5.00	2,550
1.40	470	2.50	1,005				

[a] Above gage height 4.00 feet the rating curve is a tangent, the difference being 68 per tenth.
[b] Above gage height 5.00 feet the rating curve is a tangent, the difference being 72 per tenth.
[c] Above gage height 1.40 feet this table is the same as the 1901 table.
[d] Above gage height 5.00 feet this table is the same as the 1901 table.

Rating tables for Coosawattee River at Carters—Continued.

JANUARY 1 TO DECEMBER 31 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	325	1.50	560	2.10	830	2.60	1,070
1.00	360	1.60	605	2.20	875	2.70	1,120
1.10	400	1.70	650	2.30	920	2.80	1,170
1.20	440	1.80	695	2.40	970	2.90	1,220
1.30	480	1.90	740	2.50	1,020	3.00	1,275
1.40	520	2.00	785				

[a] Above gage height 3.0 feet the rating curve is the same as the 1904 table.

Estimated monthly discharge of Coosawattee River at Carters.

[Drainage area, 531 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1896.[a]					
t 17-31	336	267	307	0.58	0.32
nber	583	173	245	.46	.51
er	460	188	284	.53	.62
ber	3,211	284	588	1.11	1.24
ber	1,031	480	684	1.29	1.49
1897.					
ry	2,033	405	710	1.33	1.53
ary	3,800	499	1,092	2.05	2.14
	14,022	698	2,908	5.47	6.31
	9,410	1,320	1,852	3.48	3.88
	1,940	674	959	1.80	2.08
	1,143	499	633	1.19	1.33
	5,600	460	787	1.48	1.71
t	1,630	284	496	0.93	1.07
ber	353	219	259	0.49	0.55
er	1,031	205	293	0.55	0.63
ber	540	219	263	0.49	0.55
ber	1,630	265	444	0.83	0.95
The year	14,022	205	891	1.67	22.73
1898.[b]					
ry	4,690	313	937	1.76	2.03
ary	771	423	601	1.13	1.18
	3,670	355	699	1.31	1.51
	8,430	722	1,470	2.76	3.08
	796	442	566	1.06	1.22
	771	313	459	0.86	0.95
	1,624	313	491	0.92	1.06
t	5,710	541	1,062	1.99	2.29
ber	8,226	423	1,300	2.45	2.73
er	14,890	499	2,159	4.06	4.68
ber	1,290	627	823	1.55	1.73
ber	1,031	541	689	1.30	1.50
The year	14,890	313	938	1.76	23.96
1899.					
ry	1,318	675	853	1.60	1.84
ary	9,994	1,031	3,448	6.48	6.75
	12,170	1,318	3,224	6.06	6.99
	3,330	1,318	2,112	3.97	4.43
	1,566	770	1,033	1.94	2.24
	1,440	495	750	1.41	1.57
	1,440	457	698	1.31	1.51
t	722	363	476	0.89	1.02
ber	363	265	305	0.57	0.63
er	537	240	305	0.57	0.66
ber	420	280	329	0.62	0.69
ber	4,282	310	691	1.30	1.50
The year	12,170	240	1,185	2.23	29.83

e estimates for 1896 were revised on the basis of the 1897 rating curve.
timates for 1898 have been revised above gage height 5.0 feet on the basis of the 1899 rating curve.

Estimated monthly discharge of Coosawattee River at Carters—Continued.

Month.	Discharge in second-feet.			Run-off	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches
1900.					
January	3,990	365	912	1.71	1.
February	13,710	455	1,707	3.21	3
March	4,350	765	1,645	3.09	3
April	2,550	970	1,294	2.43	2
May	1,127	622	783	1.47	1
June	3,630	717	1,747	3.28	3
July	2,694	670	1,344	2.53	2
August 1–25	1,022	495	632	1.19	1.
November 4–30	2,550	455	693	1.30	1
December	2,010	495	837	1.57	1
1901.					
January	14,790	765	1,625	3.05	3
February	5,070	970	1,871	3.52	3
March	14,070	815	2,214	4.17	4
April	9,750	1,290	2,306	4.34	4
May	16,950	917	2,153	4.06	4
June	2,694	970	1,538	2.90	3
July	1,455	535	923	1.74	2
August	16,230	622	2,778	5.23	6
September	12,630	970	1,761	3.32	3
October	1,075	622	783	1.47	1
November	815	622	686	1.29	1
December	15,510	765	2,089	5.06	4
The year	16,950	535	1,777	3.35	4
1902.					
January	5,430	970	1,487	2.80	3
February	15,510	1,510	2,022	4.94	5
March	11,910	1,455	3,127	5.89	6
April	1,875	1,180	1,437	2.71	3
May	1,290	670	927	1.75	2
June	1,022	495	614	1.16	1
July	622	310	469	0.88	1
August	815	280	350	0.66	
September	765	280	375	0.71	
October	1,022	250	337	0.63	
November	3,630	250	676	1.27	1
December	3,630	345	914	1.72	2
The year	15,510	250	1,111	2.09	2
1903.					
January	1,455	420	721	1.36	1
February	14,430	765	3,294	6.20	6
March	14,070	1,455	3,295	6.20	7
April	6,150	1,565	2,244	4.23	4
May	2,550	917	1,172	2.21	2
June	3,846	765	1,631	3.07	3
July	5,430	765	1,233	2.32	2
August	1,022	420	729	1.37	1
September	575	364	408	.77	
October	765	310	389	.73	
November	1,180	364	512	.96	1
December	022	364	421	.79	
The year	14,430	310	1,337	2.52	3
1904.					
January	2,097	358	575	1.08	1
February	2,410	430	791	1.49	1
March	2,604	603	1,063	2.00	2
April	1,870	603	823	1.55	1
May	2,165	393	659	1.24	1
June	1,330	326	549	1.03	1
July	772	296	408	.768	
August	2,550	269	453	.853	
September	296	184	220	.414	
October	202	184	187	.352	
November	650	184	215	.405	
December	1,870	269	534	.987	1
The year	2,694	184	539	1.01	13

Estimated monthly discharge of Coosawattee River at Carters—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
January	9,390	400	1,140	2.15	2.48
February	9,030	520	2,264	4.26	4.44
March	3,630	785	1,144	2.15	2.48
April	1,560	695	858	1.62	1.81
May	3,990	718	1,147	2.16	2.49
June	1,560	650	752	1.42	1.58
July	2,910	560	887	1.67	1.92
August	1,870	500	759	1.43	1.65
September	3,270	360	652	1.23	1.37
October	1,275	325	490	.923	1.06
November	830	325	394	.742	.828
December	12,050	400	2,026	3.82	4.40
The year	12,050	325	1,043	1.96	26.51

CARTECAY RIVER NEAR CARTECAY.

This station was established June 27, 1904, by M. R. Hall. It is located at the Cartecay Bridge on the public road 6 miles upstream from Ellijay and 1½ miles northwest of Cartecay. Turkey Creek enters from the south side and Owltown Creek from the north side between this point and Ellijay. There is probably no considerable interference from dams above the station.

The channel is straight for about 500 feet above and below the station. The current is swift. Both banks are high, but are subject to overflow. The bed of the stream is composed of bowlders and is probably permanent, the water flowing in one channel.

Discharge measurements are made from the downstream side of the single 60-foot span wooden bridge. The bridge has an approach on the right bank of 24 feet and on the left bank of 26 feet. The initial point for soundings is the edge of the abutment on the right bank, downstream side.

The gage is a vertical 10-foot timber, fastened to the sill and downstream post of the trestle bent at the right bank. It is read once each day by S. A. Burrell. The bench mark is the top of the downstream end of the first floor beam from the right bank, marked by nails and white paint; elevation, 16.50 feet above the datum of the gage.

Discharge measurements of Cartecay River near Cartecay.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec.-ft.*
May 9	1.30	176	April 19	1.20	167
June 27	.90	86	June 22	1.45	230
August 31	.85	94	October 16	1.07	137
October 12	.65	70			
December 13	.80	78			

Daily gage height, in feet, of Cartecay River near Cartecay.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov
1904.							1904.					
1	1.1	1.1	0.8	0.9	0.75	1.15	17	1.3	1.3	1.3	0.7	0.7
2	1.1	1.2	.85	.....	.8	.9	18	1.5	1.25	2.1	.7	.8
3	1.3	2.4	1.2	.....	.8	1.1	19	3.05	3.55	.9	.75	.8
4	1.5	1.65	1.1	.....	.85	1.0	20	3.05	2.15	.9	.6	.9
5	1.7	2.3	.9	.....	.9	1.5	21	2.2	1.9	.85	.65	.8
6	1.75	2.85	.9	.....	.8	1.2	22	1.7	1.7	.8	.75	.9
7	3.3	1.9	.85	.....	.85	1.2	23	1.6	1.3	2.3	.75	.9
8	2.2	1.7	.8	.....	.9	1.1	24	2.2	1.25	2.15	.75	.9
9	1.4	1.5	1.4	.....	.95	1.0	25	1.95	3.35	.95	.65	.8
10	1.3	1.45	.85	.....	.9	1.0	26	1.3	2.7	1.9	.6	.8
11	1.35	1.4	.8	.....	1.2	.9	27	1.25	1.6	.8	.65	.8
12	3.5	2.65	.8	.65	1.3	.9	28	1.7	1.15	.8	.7	.8
13	5.4	2.1	.85	.....	1.1	.8	29	1.25	1.1	1.2	.75	.8
14	2.3	1.7	.8	.....	.95	.8	30	1.1	.9	.9	.7	1.3
15	2.1	1.5	.75	.....	.9	.85	31	.....	.85	.....	.7	.....
16	1.3	1.35	.8	.....	.8	.85						

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov
1905.											
1	0.9	0.95	1.45	1.3	1.7	1.5	1.6	1.1	1.15	1.3	0.9
2	.95	.95	1.4	1.3	1.7	1.4	1.5	1.0	1.15	1.2	1.3
3	.95	.9	1.4	1.25	1.6	1.35	1.4	1.0	1.2	1.2	1.2
4	.95	.85	1.3	1.2	1.5	1.2	1.4	.95	1.25	1.7	1.3
5	.9	.9	1.35	1.6	1.45	1.2	1.35	.9	1.2	1.4	1.1
6	1.55	1.1	1.4	1.5	1.4	1.15	1.2	.9	1.2	1.3	1.1
7	1.2	1.1	1.45	1.3	1.4	1.1	1.2	.95	1.15	1.2	1.1
8	1.1	2.1	1.3	1.25	1.9	1.15	1.2	1.6	1.1	1.1	.9
9	1.1	2.9	1.3	1.2	1.6	1.1	1.15	1.9	1.15	1.0	.9
10	1.2	2.8	1.65	1.1	1.5	1.1	1.15	1.8	1.15	1.0	.9
11	1.2	1.6	1.3	1.1	1.35	1.1	1.2	1.6	1.2	1.0	.9
12	9.7	1.4	1.3	1.7	1.3	1.0	4.3	1.5	1.9	1.1	.8
13	2.5	2.8	1.25	1.4	1.3	1.0	3.6	1.5	1.4	1.1	.8
14	1.7	1.6	1.2	1.3	1.25	1.1	2.7	1.6	1.3	1.1	.9
15	1.6	1.5	1.2	1.35	1.3	1.1	2.1	1.6	1.2	1.0	.9
16	1.4	1.5	1.2	1.3	2.1	1.6	1.9	3.6	1.2	.9	.9
17	1.45	1.4	1.25	1.3	1.6	1.4	1.3	2.9	1.15	.9	.9
18	1.35	1.4	1.25	1.3	1.4	1.2	1.3	2.1	1.15	.95	1.0
19	1.3	1.35	1.2	1.25	1.4	1.2	1.25	1.6	1.1	1.0	1.7
20	1.2	6.5	1.6	1.25	1.3	1.2	1.25	1.5	1.1	1.0	1.5
21	1.2	3.6	2.6	1.25	1.3	1.6	1.2	1.4	1.1	.9	1.3
22	1.15	2.2	1.8	1.2	2.6	2.3	1.2	1.35	.9	1.1	1.1
23	1.15	1.9	1.6	1.2	1.8	1.9	1.2	1.3	.9	1.1	1.1
24	1.2	1.7	1.5	1.25	1.7	1.6	1.1	1.3	.9	1.1	1.1
25	1.1	1.7	1.5	1.2	1.6	1.5	1.1	1.25	.95	1.3	1.5
26	1.1	1.65	1.5	1.25	1.6	1.5	1.1	1.2	.95	1.2	1.4
27	1.0	1.65	1.4	1.5	1.5	1.4	1.2	1.2	.9	1.1	1.3
28	1.0	1.5	1.3	1.3	1.4	1.4	1.2	1.2	1.0	1.1	1.2
29	1.0	.....	1.3	1.9	1.4	1.3	1.15	1.15	1.0	1.1	1.4
30	1.15	.....	1.6	1.8	1.35	1.9	1.15	1.1	1.6	.9	1.2
31	1.1	.....	1.4	.....	1.6	.....	1.15	1.1	.....	.9	.....

Rating table for Cartecay River near Cartecay, from July 1, 1904, to December 31.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	56	1.00	113	1.40	215	1.80	366
.70	67	1.10	134	1.50	249	1.90	411
.80	80	1.20	158	1.60	286	2.00	456
.90	95	1.30	185	1.70	326		

[a] As the highest measurement is at 1.5 feet the table has not been extended beyond 2 feet. F
reason no monthly estimates have been made. The table as given covers the low-water period

ELLIJAY RIVER, AT ELLIJAY.

This station was established June 28, 1904, by M. R. Hall. It is located at a wagon bridge about one-half mile east of Ellijay, and about the same distance above the junction of Ellijay and Cartecay rivers.

The channel is straight for about 500 feet above and below the station. The right bank is about 12 feet high and the left about 10 feet. Both banks are bordered by fields and are subject to overflow. There is one channel, broken by one wooden pier. The bed of the stream is composed of rock, and the current ranges from very swift above the station to sluggish below.

Discharge measurements are made from the open wooden wagon bridge, which has two 40-foot spans and 50-foot approaches on each bank. The initial point for soundings is the end of the bridge at the right bank, on the downstream side.

A gage staff, reading from 2 to 6 feet, is nailed to the downstream vertical post at the right bank, and a bench mark established for reference. Regular gage readings are not maintained. The bench mark is a small nail and white paint mark in the downstream vertical post at the right bank; elevation, 7.00 feet above datum of the assumed gage.

Discharge measurements of Ellijay River at Ellijay.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
December 9	.....	76	December 14	1.20	66
1904.			1905.		
May 10	1.80	154	April 18	1.70	145
June 28	1.35	94	June 21	1.78	156
August 30	1.22	68	October 16	1.42	114
October 12	1.07	42			

MOUNTAINTOWN CREEK NEAR ELLIJAY.

This station was established May 10, 1904, by O. P. Hall. It is located at the covered bridge, known as Charles Bridge, about 4 miles west of Ellijay, and about the same distance above the mouth of the creek. This bridge consists of a single span of 54 feet, with short trestle approaches at either end. Discharge measurements are made either from the bridge, where the meter is lowered through holes in the floor, or at a foot log half a mile below. The initial point for soundings is the end of the trestle approach at the right bank.

The channel is straight for about 500 feet above and 100 feet below the station. Both banks are high and not liable to overflow. The

bed of the stream is rocky. The water is shallow and swift at the bridge, the better section being at the foot log below the bridge.

Gage heights are determined directly from the bench mark, which is a nail driven into the vertical post of the main bent under the right end of the bridge 6 feet above the top of the mud sill of the bent; elevation, 7.00 feet above the datum of the assumed gage.

Discharge measurements of Mountaintown Creek near Ellijay.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec.-ft.*
May 10	1.17	157	April 19	1.05	13
August 31	.85	79	October 17	.93	9
October 12	.75	31			

TALKING ROCK CREEK NEAR CARTERS.

This station was established May 26, 1904, by O. P. Hall. It is located about 3 miles above the mouth of Talking Rock Creek and about the same distance east of Carters. Numerous measurements of the creek had previously been made in connection with measurements at the Coosawattee River station.

Both banks are high and will probably not overflow. There is one channel at all stages. The section is a good one. Discharge measurements are made from a boat just above R. L. Hill's boat landing, or by wading at a shoal a short distance below. Gage heights are determined directly from the bench mark, which is a nail in a large elm tree on the left bank at R. L. Hill's boat landing; elevation, 7.50 feet above the datum of the assumed gage.

Discharge measurements of Talking Rock Creek near Carters.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec.-ft.*
May 26	1.24	49	June 6	1.59	14
June 25	1.08	34	September 28	1.16	5
August 23	1.07	40			

BIG CEDAR CREEK NEAR CAVESPRING.

This station was established in 1905. It is located at the wagon bridge about 3 miles north of Cavespring, 1 mile below the Southern Railway bridge, and half a mile below the mouth of Little Cedar Creek.

The channel is straight for about 200 feet above and 300 feet below the bridge. The right bank is low and will overflow to the extent of the 100-foot wooden approach. The left bank is high and will not overflow. The bed is of sand and mud, and is therefore probably

shifting. The current is sluggish at low stages. Measurements are made from the single iron span 91 feet long. The initial point for soundings is the end of the bridge at the left bank, upstream.

Gage heights are determined directly from the bench mark, which is the top of the upstream end of the second floor beam from the right-bank end of the bridge; elevation, 20.00 feet above the datum of the assumed gage.

Discharge measurement of Big Cedar Creek near Cavespring.

Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*
July 25	2.70	117

TALLAPOOSA RIVER AT BUCHANAN BRIDGE, NEAR TALLAPOOSA.

This station was established October 21, 1901, by M. R. Hall. It is located at Buchanan Bridge, about 4 miles north of Tallapoosa, and about 2 miles above the station on Tallapoosa River at Adderhold Bridge. Discharge measurements are made from the single-span iron highway bridge, which has a trestle approach of 100 feet on the right bank and of 50 feet on the left bank. The initial point for soundings is the end of the bridge at the right bank, downstream side. The channel is straight for about 800 feet above and 1,000 feet below the station. The current is moderate above and swift below the measuring section and the banks rarely overflow. The bed of the stream is composed of rock and gravel, free from vegetation, and is probably constant; there is but one channel at all stages, broken at the higher levels by the piers and trestlework of the bridge. The bench mark is the top of the downstream end of the center floor beam, the third from either end; elevation, 25.25 feet above gage datum.

Discharge measurements of Tallapoosa River at Buchanan Bridge, near Tallapoosa.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
March 26	1.55	180	August 31	0.81	59
May 14	.83	39	September 26	.71	33
July 19	.65	22			

TALLAPOOSA RIVER AT ADDERHOLD BRIDGE, NEAR TALLAPOOSA.

This station was established on January 7, 1901, by M. R. Hall. It is located at Adderhold Bridge, about 2 miles north of Tallapoosa, and about 2 miles below the station on Tallapoosa River at Buchanan Bridge. Discharge measurements are made from the downstream side of the single-span iron highway bridge, which has trestle approaches at either end. The initial point for soundings is the end of the

bridge at the left bank, downstream side. The channel is straigh about 300 feet above and 500 feet below the station. The curre swift above and sluggish below. Both banks are wooded and subject to overflow under the trestle approaches during high w The bed of the stream is composed of sand, and is probably cons There is but one channel at all stages, broken during the higher l by the piers and trestlework of the bridge. The bench mark i top of the downstream end of the first floor beam from the left h elevation, 22.00 feet above gage datum.

Discharge measurements of Tallapoosa River at Adderhold Bridge, near Tallap

Date.	Gage height.	Discharge.	Date.	Gage height.
1904.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*
March 9	1.20	274	July 19	0.30
March 26	1.22	218	August 31	.65
May 14	.60	70	September 26	.30

MISCELLANEOUS MEASUREMENTS IN MOBILE RIVER DRAINAGE B.

The following is a list of miscellaneous discharge measuren made in Mobile River drainage basin in Georgia:

Big Cedar Creek. This stream enters Coosa River about 6 northwest of Cavespring. Measurements were made from the stream side of a single-span steel bridge 2½ miles northwest of C spring and one-fourth mile above the Southern Railway bridge. bench mark is the top of the second iron floor beam from the righ of the bridge, upstream side, 17.00 feet above the datum of assumed gage.

January 21, 1904: Width, 62 feet; area, 207 square feet; mean velocity, 0.37 fo second; gage height, 3.13 feet; discharge, 78 second-feet.

September 28, 1904: Width, 67 feet; area, 177 square feet; mean velocity, 0.2 per second; gage height, 3.00 feet; discharge, 51 second-feet.

July 25, 1905: Width, 68 feet; area, 186 square feet; mean velocity, 0.42 fo second; gage height, 3.13 feet; discharge, 77 second-feet.

Cave Spring. This spring is tributary to Little Cedar Creek measurement was made January 21, 1904, at the footbridge at C spring. The water surface was 16½ inches below the upstream si the bridge floor, 6 inches from the right end of the bridge.

Width, 13 feet; area, 5.6 square feet; mean velocity, 0.94 foot per second; disc 5.3 second-feet.

Conasauga River. This stream is a tributary of Oostanaula R A measurement was made November 25, 1904, from a boat at Ferry, 2 miles from Resaca, Ga. The bench mark is a small nail large leaning willow tree on the left bank, about 200 feet below ferry, 5.00 feet above the datum of the gage.

Width, 130 feet; area, 219 square feet; mean velocity, 0.74 foot per second; height, 2.65 feet; discharge, 163 second-feet.

Etowah River.—A measurement was made July 27, 1904, at Fields Bridge, about 6 miles below Canton. The bench mark is a chisel cut and white paint mark at intermediate post, the second floor beam of the main span from the left end of the bridge, downstream side, 36.00 feet above the datum of the gage.

Width, 89 feet; area, 307 square feet; mean velocity, 1.05 feet per second; gage height, 2.67 feet; discharge, 322 second-feet.

Measurements were also made at Hardins Bridge, 4 miles south of Kingston, Ga., as follows:

January 24, 1904: Width, 188 feet; area, 1,178 square feet; mean velocity, 1.60 feet per second; gage height, 3.45 feet; discharge, 1,894 second-feet.

April 14, 1904: Width, 188 feet; area, 1,154 square feet; mean velocity, 1.21 feet per second; gage height, 3.27 feet; discharge, 1,401 second-feet.

July 29, 1904: Width, 185 feet; area, 1,007 square feet; mean velocity, 0.62 foot per second; gage height, 2.56 feet; discharge, 625 second-feet.

A 5-foot section of gage rod is fastened to a tree on the left bank.

Jack River.—A measurement was made near Alaculsy, October 5, 1904, just above the falls, about 5 miles above the mouth of the river and 23 miles from Blue Ridge, Ga.

Width, 7 feet; area, 7 square feet; mean velocity, 1.86 feet per second; discharge, 13 second-feet.

Little Cedar Creek.—This stream enters Big Cedar Creek about 2 miles north of Cavespring, Ga. A measurement was made September 28, 1904, from the bridge near Cavespring. The bench mark is the top of the first floor beam from the right bank, downstream end, 9.00 feet above the datum of the gage.

Width, 30 feet; area, 18 square feet; mean velocity, 1.00 foot per second; gage height, 1.27 feet; discharge, 18 second-feet.

Oothkalooga Creek.—This stream is a tributary of Oostanaula River. A measurement was made May 6, 1904, at a bridge about 1 mile from the mouth of the creek and 1 mile west of Calhoun. The bench mark is the downstream end of the top of cross timber on middle bent, 16.00 feet above the datum of the gage.

Width, 45 feet; area, 50 square feet; mean velocity, 0.64 foot per second; gage height, 2.15 feet; discharge, 32 second-feet.

Pinelog Creek.—This stream flows into Sallacoa Creek, a tributary of Coosawattee River. A measurement was made May 5, 1904, at Butler's bridge, about 1 mile above the mouth, near Cash. The bench mark is the top of the downstream end of the cross timber on first bent from the left bank, 17.00 feet above the datum of the gage.

Width, 54 feet; area, 150 square feet; mean velocity, 0.27 foot per second; gage, height, 2.80 feet; discharge, 41 second-feet.

Sallacoa Creek.—This stream is a tributary of Coosawattee River. A measurement was made May 5, 1904, at Covington's bridge, about 4 miles above the mouth of Pinelog Creek and 4 miles east of Cash, Ga.

The bench mark is the upstream end of the top of cross timber over the first bent from the left bank, 16.00 feet above the datum of the gage.

Width, 42 feet; area, 164 square feet; mean velocity, 0.15 foot per second; gage height, 2.60 feet; discharge, 24 second-feet.

Tallapoosa River.—A measurement was made near Tallapoosa, on March 9, 1904, from the wooden bridge near the Southern Railway and one-half mile below Bentley's dam, below the mouth of Walkers Creek. The bench mark is the top of the upper end of the floor beam on top of wooden pier, 106 feet from the initial point for soundings, 25.00 feet above the datum of the gage.

Width, 89 feet; area, 517 square feet; mean velocity, 0.74 foot per second; gage height, 6.25 feet; discharge, 381 second-feet.

RIVER SURVEYS IN MOBILE RIVER DRAINAGE BASIN.

ETOWAH RIVER.

The following list of elevations of water surface on Etowah River from Rome up to the mouth of Little River are from a survey made in 1879 by Ernest Ruhl, of the Corps of Engineers, U. S. Army. The elevations are based on an assumed datum, which is about 376 feet above sea level.

Elevations on Etowah River from Rome to mouth of Little River.

Distance.	Description of points.	Elevation.
Miles.		*Feet.*
0.0	Rome, Ga., Broad Street Bridge, water surface	376
0.3	Rome, Ga., Silver Creek, mouth, water surface	376.6
0.5	Rome, Ga., Southern Railway bridge, water surface	376.5
1.0	Water surface	377
2.5	Water surface	382
3.0	Water surface	384.1
3.7	Water surface	386
4.3	Water surface	389
4.7	Water surface	390.1
5.5	Water surface	390.1
5.7	Water surface	390.5
5.8	Water surface	390
6.3	Freemans Ferry, water surface	392.2
7.0	Water surface	396
7.5	Dykes Creek, 0.3 mile below mouth of, water surface	396.5
8.0	Water surface	398.4
9.0	Water surface	398.7
9.3	Water surface	401.1
9.5	Water surface	402
9.8	Water surface	402.5
11.6	Bass Ferry	
12.0	Water surface	403.2
12.5	Water surface	404.3
13.0	Water surface	405.7
13.3	Water surface	406.5
14.0	Water surface	408.5
14.5	Thomas Creek 0.3 mile below mouth of, water surface	410
15.5	Water surface	413.1
15.8	Hanleys Ferry, half mile below, water surface	410.5
16.5	Water surface	411.4
16.7	Water surface	413.1
17.0	Water surface	417.9
17.3	Water surface	419
18.0	Water surface	419.5
18.2	Water surface	420
19.0	Woolleys Bridge, water surface	420.5
19.5	Water surface	422.3
20.1	Conasene Creek, water surface	423.1
20.2	Water surface	424
20.4	Water surface	425

Elevations on Etowah River from Rome to mouth of Little River—Continued.

Distance.	Description of points.	Elevation.
Miles.		*Feet.*
20.5	Two Run Creek, mouth of, water surface	326.8
21.7	Water surface	327.8
22.0	Water surface	330
22.3	Water surface	331
22.5	Water surface	331.1
22.6	Water surface	332
22.9	Dodds Slough, water surface	
23.0	Water surface	332.1
23.2	Water surface	333
23.5	Water surface	333.7
23.8	Water surface	340
24.5	Water surface	341.7
25.0	Water surface	342.5
25.3	Water surface	344.4
26.0	Water surface	344.9
27.5	Water surface	346.6
27.8	Water surface	346.7
28.5	Water surface	349
29.2	Water surface	350.7
29.5	Water surface	351.6
29.7	Water surface	352
30.5	Water surface	354
30.7	Water surface	355.53
31.0	Uharlee Creek, 0.4 mile below mouth of, water surface	356
31.8	Water surface	356.1
32.8	Water surface	358.2
34.0	Water surface	360
34.5	Water surface	362
35.0	Richland Creek, mouth of, water surface	364.2
35.5	Water surface	367
37.0	Water surface	367.3
37.5	Water surface	368
38.6	Rockmart Railroad bridge, water surface	369
38.8	Pettits Creek, mouth, and Rowlands Ferry, 0.2 mile below, water surface	369.3
39.2	Water surface	371
39.5	Water surface	371.5
40.8	Water surface	375.5
41.2	Pumpkinvine Creek, 0.7 mile below mouth, water surface	376.7
42.2	Water surface	377.9
42.5	Water surface	379.6
42.7	Water surface	380.4
43.5	Water surface	383
43.9	Tumlins milldam in 1879, foot of, water surface	383.5
43.9	Tumlins milldam in 1879, head of, water surface	388
44.2	Water surface	388
44.4	Wagon bridge, water surface	388.9
45.0	Jefferson milldam, foot of, water surface	390.5
45.0	Jefferson milldam, head of, water surface	395.5
45.1	Western and Atlantic Railroad bridge, water surface	395.5
46.0	Water surface	395.5
47.0	Small branch, near mouth, water surface	398
47.1	Water surface	400
47.8	Water surface	405
48.0	Water surface	410.5
48.5	Near mouth of Altona Creek, water surface	418.4
48.8	Water surface	422
49.0	Near mouth of Stamp Creek, water surface	435.5
50.0	Water surface	452.3
50.5	Water surface	466.3
51.0	Websters Ferry, water surface	468.1
51.2	Water surface	469.4
52.0	Water surface	477.3
52.4	Water surface	480
52.8	Illinois Creek, half mile below mouth, water surface	486.4
53.7	Water surface	488
54.5	Water surface	488.3
54.8	Gaults Ferry, half mile below, water surface	489.2
55.5	Owl Creek, 0.2 mile below mouth, water surface	489.3
56.7	Water surface	491
57.2	Water surface	491.1
57.7	Water surface	491.9
58.0	Lovengoods Bridge, 0.8 mile below, water surface	494.8
59.7	Water surface	497
59.8	Water surface	497.6
60.4	Water surface	500.1
60.7	Water surface	502.5
61.7	Water surface	502.5
62.2	Wheelers milldam, foot of	504.5
62.2	Wheelers milldam, head of	508
63.0	Little River, mouth, water surface	508

SURVEY OF COOSAWATTEE RIVER.

From May 29 to July 12, 1900, a survey of a part of Coosawattee River was made, under the supervision of B. M. Hall, resident hydrographer, by Olin P. Hall, who was field assistant, levelman, and topographer. No camp outfit was carried. The levelman read his distances with the stadia, and identified land lines and tributaries from a township or district map of the old State survey. This map embraces two land districts, the eleventh and the twenty-fifth. The eleventh was found to be correct, but the twenty-fifth was incorrect. The survey began at the Geological Survey gaging station at Carters, with zero of the gage as a level datum, and extended up the river to Ellijay, a distance of 24 miles. The total fall between the two places was found to be 581.6 feet. This 24 miles of river cuts through the Cohutta Mountains and enters the Paleozoic formation at Carter's mill, about 2 miles above the gaging station, which is the head of navigation on the river. It is along a continuous shoal, and the conditions are such that water power can be developed at any point desired. The only utilized power is at Carter's mill, where there is an 8-foot dam across the river.

Elevations on Coosawattee River from Carters to Ellijay.

Distance.	Description of points.	Elevation above gage datum.
Miles.		*Feet.*
0.0	Zero of gage at Carters, Ga.	0.[illegible]
0.0	Water surface at gaging station May 29, 1900	1.[illegible]
0.3	Mouth of Talking Rock Creek, bench mark	15.[illegible]
0.3	Mouth of Talking Rock Creek, water surface	3.[illegible]
1.75	Below Carter's dam, water surface	17.[illegible]
1.75	Above Carter's dam, water surface	25.[illegible]
1.75	Small birch on right bank of river	29.[illegible]
2.25	Mouth of Fishers Creek, water surface	36
2.5	County line between Murray and Gilmer counties, water surface	40.[illegible]
3.25	Mouth of small branch, water surface	51.[illegible]
3.25	Small maple 30 feet beyond branch	55.[illegible]
4.2	Mouth of Camp Branch, water surface	60.[illegible]
4.2	Pine root at mouth of Camp Creek	72.[illegible]
4.4	Mouth of Harris Creek, water surface	79.[illegible]
4.4	Root of small poplar opposite mouth of Harris Creek	82.[illegible]
5.62	Mouth of Wurley Creek, water surface	129.[illegible]
5.62	Large basswood	135.[illegible]
5.72	1,000 feet above Wurley Creek, water surface	139.[illegible]
6.1	Mouth of Crawfords Creek, 37½ feet fall in 2,300 feet, water surface	186.[illegible]
6.1	Small white oak opposite Crawfords Creek	191.[illegible]
9.0	Opposite mouth of Tails Creek, water surface	316.[illegible]
9.0	Large pine 50 feet south of Tails Creek	322.[illegible]
10.25	Opposite mouth of Flat Creek, water surface	344.[illegible]
10.25	Small white oak opposite Flat Creek at John Goble's boat landing	354.[illegible]
10.5	Water surface	350.[illegible]
10.9	Below bend of river, water surface	363.[illegible]
11.15	Foot of shoals, water surface	375.[illegible]
12.25	Mouth of small branch from the west, water surface	409.[illegible]
13.25	Line between land districts 25 and 11, water surface	440.[illegible]
14.0	Mouth of Mountaintown Creek, water surface	456.[illegible]
14.0	Small white oak on north bank of Mountaintown Creek	464.[illegible]
16.4	Gentry's boat landing, on lot No. 176, water surface	510.[illegible]
17.65	200 feet below mouth of Early Creek, water surface	532.[illegible]
18.18	Smith's boat landing, water surface	538.[illegible]
18.22	Levi Smith's ford, water surface	567.[illegible]

Elevations on Coosawattee River from Carters to Ellijay—Continued.

Distance.	Description of points.	Elevation above gage datum.
Miles.		*Feet.*
18.25	Root of small red oak 220 feet above ford	546.81
19.7	Mouth of branch near corner of lots Nos. 103, 104, 113, and 114, in eleventh district, water surface	557.08
22.8	Ford 100 feet below mouth of Mill Creek, water surface	577.09
23.3	Covered wagon bridge over Coosawattee River at Ellijay, Ga., water surface	581.4
23.3	Large oak on north bank 50 feet above bridge	590.75
23.6	Junction of Cartecay and Ellijay rivers, water surface	581.92
24.0	A. K. and N. R. R. bridge on Cartecay River, water surface	583.39
24.0	Center of stone block on top of south pier of railroad bridge	603.29
24.0	Base of rail on south end of railroad bridge	605.44
24.0	Base of rail on front of A. K. and N. R. R. depot at Ellijay, Ga	613.77

WATER POWER IN MOBILE RIVER DRAINAGE BASIN.

ETOWAH RIVER.

From Rome up to the Western and Atlantic railroad crossing, near Cartersville, a distance of 45 miles, Etowah River is mostly swift, but has no large shoals. The total fall is about 115 feet, which includes numerous small shoals. At a few places the fall is 5 or 6 feet in a mile or less, and at one place near Kingston the fall is 33 feet in 8½ miles. One and one-fourth miles below the railroad bridge, at the old Tumlin mill site, is the large corn mill of the Etowah Milling Company, utilizing about 6 feet of fall.

Immediately below the railroad bridge is an old mill site from which the mill and the 5-foot dam are entirely gone. About 2 miles above the railroad bridge begins a very fine water power, which was once partly developed and, before the civil war, operated the Cooper Iron Works and a large flour mill. At present only the ruins of what is said to have been "a half-million dollar plant" are to be seen. This power has a fall of 90 feet in about 6 miles. Above this point there are numerous good small power sites, some of which are developed, but no great falls occur until the upper portion of the river is reached.

On Amicalola River, a large tributary of the Etowah, and on Etowah River above the mouth of the Amicalola, there are many excellent shoals having large amounts of fall.

HIWASSEE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Hiwassee River rises in the northern part of Georgia and flows into Tennessee River about 30 miles above Chattanooga, Tenn. Its principal tributaries are the Toccoa (Okoee) and the Nottely. The United States Geological Survey has maintained, among others in this basin, the following stations: On Toccoa River near Blue Ridge, Ga.; on the Okoee River at McCays, Tenn.; on Nottely River at Ranger, N. C.; and on Hiwassee River at Murphy, N. C. The stations in North Carolina and Tennessee, mentioned above, are included here, as the data regarding the rivers in this basin will be valuable in estimating the flow of these streams at points above.

STREAM FLOW.

HIWASSEE RIVER AT MURPHY, N. C.

This station was established July 26, 1896, by E. W. Myers. It is located at the highway bridge in Murphy, N. C., about 80 feet above the Atlanta, Knoxville and Northern Railroad bridge and one-half mile above the mouth of Valley River.

The channel is straight for about 500 feet above and below the station. The right bank is high and rocky and will not overflow. The left bank will overflow for a short distance around the abutment. The bed of the stream is rocky and rough, and makes soundings uncertain. The bed is permanent and the flow is rapid. Discharge measurements are made from the sidewalk on the upstream side of the single-span highway bridge. The bridge is 195 feet long, supported by stone abutments. The initial point for soundings is the end of the iron hand rail on the right bank, upstream side of the bridge.

A standard chain gage is fastened to the top of the downstream end of the first iron floor beam from the right bank in the space between the bridge floor and the lower chords; length of chain, 27.05 feet. It is read once each day by William Mingus. Bench marks were established as follows: (1) The downstream side of the top of the stone pier at the right bank; elevation, 22.55 feet. (2) The top of the downstream end of the first iron floor beam from the right end of the bridge; elevation, 25.05 feet.

Discharge measurements of Hiwassee River at Murphy, N. C.

Date.	Gage height.	Discharge.
1896.	*Feet.*	*Sec.-ft.*
›23	3.82	366
ust 10	3.95	382
ember 22	4.01	517
1897.		
ust 20	5.33	528
›ber 14	4.76	267
›ber 29	4.71	253
1898.		
ıary 21	6.05	1,170
ember 8	6.80	1,620
1899.		
ruary 28	7.50	2,150
› 23	5.17	400
› 23	5.30	436
ember 28	4.93	304
ember 28	5.00	345
mber 7	5.10	317
mber 29	5.50	613
1900.		
ruary 11	6.10	1,534
ruary 14	7.95	4,567
il 29	6.10	1,466
26	5.52	755
› 29	7.10	3,405
8	5.90	1,155
ember 9	5.05	345
ember 18	5.20	443
mber 13	5.53	762
mber 13	5.45	698
mber 28	5.70	865
1901.		
ruary 24	5.70	725
il 17	6.15	1,522
12	6.40	2,107
12	5.45	665
ust 16	8.00	4,974
ember 20	6.02	1,106
September 20	6.02	1,324
September 20	6.02	1,257
September 20	6.02	1,166
September 20	6.02	1,246
September 20	6.03	1,182
November 8	5.25	462
December 13	5.32	480
1902.		
August 12	4.80	213
August 23	4.80	186
September 18	4.80	198
September 18	4.80	216
October 24	4.87	260
October 24	4.90	271
1903.		
March 6	6.60	1,747
March 28	6.75	2,226
April 28	6.04	1,302
July 29	5.16	435
August 17	5.19	437
August 27	5.00	315
October 2	4.88	217
October 3	4.88	220
December 3	4.83	233
1904.		
February 22	6.63	1,996
February 24	6.00	1,138
March 1	5.54	661
March 2	5.54	644
May 12	5.66	754
June 29	5.53	639
August 29	5.10	344
October 6	4.80	183
December 15	5.02	287
1905.		
April 15	5.84	896
June 13	5.38	517
October 13	5.16	421

Daily gage height, in feet, of Hiwassee River at Murphy, N. C.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1896.						
.....	3.72	4.02	3.65	3.74	3.66	5.2
.....	3.7	4.02	3.61	3.68	3.7	4.7
.....	3.75	4.11	3.62	3.65	3.72	4.52
.....	4.0	3.95	3.61	3.60	4.9	4.52
.....	3.9	3.9	3.61	3.62	4.1	4.2
.....	4.62	3.9	3.9	3.55	3.9	4.2
.....	4.98	3.95	3.66	3.6	3.9	4.15
.....	6.72	3.9	3.62	3.51	3.9	4.1
.....	6.95	3.86	3.6	3.6	3.82	4.3
.....	5.24	4.0	3.6	3.65	3.8	4.1
.....	4.75	3.9	3.6	3.65	3.76	4.1
.....	4.82	3.81	3.67	3.65	7.53	4.1
.....	4.77	3.81	3.56	3.72	5.4	4.05
.....	4.65	3.72	3.58	3.65	4.53	4.02
.....	4.42	3.75	3.8	3.65	4.3	4.1
.....	4.55	3.92	3.62	3.6	4.12	4.05

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1896.						
17.....	4.48	3.78	3.6	3.65	4.5	4.05
18.....	4.54	3.74	3.6	3.56	3.95	4.0
19.....	4.35	3.7	3.58	3.5	3.91	4.0
20.....	4.28	3.68	3.56	3.6	3.9	4.0
21.....	4.32	3.7	3.56	3.6	3.9	4.0
22.....	4.6	3.7	3.62	3.56	3.85	4.0
23.....	5.1	3.65	3.85	3.6	3.8	3.95
24.....	4.61	3.9	3.6	3.9	3.8	3.95
25.....	4.4	3.8	3.6	3.7	3.8	3.95
26.....	4.3	3.72	3.6	3.62	3.84	3.9
27.....	4.3	3.72	3.6	3.62	4.0	3.9
28.....	4.25	3.7	3.65	3.65	4.0	3.9
29.....	4.12	3.7	3.6	3.74	5.03	3.9
30.....	4.01	3.65	4.2	3.8	6.1	3.9
31.....	4.02	3.65	.....	3.82	.....	3.9

Daily gage height, in feet, of Hiwassee River at Murphy, N. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1897.												
1	3.9	4.8	4.6	5.4	4.8	4.16	3.9	4.2			5.0	5.0
2	3.9	5.5	4.5	5.5	4.7	4.15	3.9	4.32			5.4	5.0
3	3.9	4.9	4.55	5.38	4.65	4.12	3.9	4.2			5.1	5.1
4	3.9	4.62	4.7	6.26	4.6	4.1	3.9	4.1			5.02	5.6
5	4.12	4.6	4.6	8.2	4.55	4.3	4.15	4.35			5.0	6.1
6	4.02	5.15	9.2	6.12	4.52	4.12	4.0	4.2			5.0	5.5
7	4.0	5.4	6.5	5.75	4.5	4.1	4.02	4.2			4.95	5.5
8	4.0	5.12	5.65	5.5	4.5	4.1	4.1				5.0	5.2
9	3.92	5.1	5.4	6.1	4.5	4.22	4.1				4.98	5.12
10	3.92	4.85	5.62	5.35	4.45	4.1	4.25				5.0	5.1
11	4.0	4.85	5.5	5.3	4.52	4.02	4.15				5.0	5.1
12	3.9	4.82	9.9	5.15	4.4	4.05	4.0				4.95	5.0
13	3.92	4.82	6.85	5.05	5.0	4.05	3.98				4.95	5.02
14	4.4	4.12	6.7	5.05	4.8	4.0	3.9				5.0	6.2
15	4.6	4.7	6.12	5.5	4.6	4.0	3.85				5.0	5.55
16	4.15	4.6	7.65	5.05	4.5	4.1	3.9				5.0	5.3
17	4.55		6.3	5.0	4.5	4.03	4.5				4.95	5.25
18	4.4		6.0	4.9	4.42	4.1	4.05				4.95	5.2
19	4.4		7.05	4.8	4.4	4.2	5.72				4.95	5.4
20	5.1		6.8	4.8	4.32	4.15	5.0			5.0	4.95	6.0
21	4.7	4.8	6.1	4.7	4.36	4.05	4.5			4.75	4.95	7.35
22	4.52	4.5	5.8	4.7	4.35	4.0	4.85			4.75	4.95	6.85
23	4.4	7.92	5.55	4.7	4.3	4.0	4.34			4.7	4.9	6.15
24	4.4	5.5	5.4	4.7	4.26	4.0	4.2			4.7	4.9	5.8
25	4.4	5.1	5.3	4.65	4.25	4.0	10.85			4.7	5.0	5.5
26	4.2	4.97	5.15	4.7	4.22	4.0	6.2			4.65	4.98	5.85
27	4.3	4.7	5.1	4.63	4.2	3.9	5.2			4.66	5.0	5.6
28	4.1	4.64	5.0	4.6	4.2	3.9	4.72			4.7	5.05	5.5
29	4.15		4.9	4.6	4.2	4.3	4.52			4.72	5.0	5.4
30	4.15		5.0	4.68	4.2	4.0	4.4			4.9	5.1	5.4
31	4.15		4.9		4.2		4.25			4.87		5.3
1898.												
1	5.3	5.6	5.22	7.0	5.8	5.12	4.95	5.82	5.4	5.6	5.85	6.0
2	5.2	5.45	5.2	6.5	5.8	5.12	4.95	5.6	12.05	5.6	5.85	5.9
3	5.1	5.62	5.32	6.21	5.7	5.1	4.9	5.82	13.97	5.5	5.8	5.85
4	5.3	5.5	5.3	6.1	5.65	5.1	4.9	9.8	10.1	14.4	5.8	5.9
5	5.25	5.5	5.21	8.75	5.65	5.1	5.5	9.35	9.75	11.6	5.8	6.1
6	5.3	5.42	5.2	7.0	5.51	5.2	5.2	6.75	7.5	8.3	6.1	6.1
7	5.3	5.4	5.2	6.55	5.6	5.1	5.1	6.5	7.1	7.3	5.85	6.1
8	5.3	5.4	5.2	6.3	5.6	5.1	5.31	7.02	6.85	7.0	5.8	6.0
9	5.2	5.4	5.2	6.11	5.6	5.1	5.1	6.8	6.6	6.7	5.8	5.95
10	5.25	5.4	5.2	6.05	5.5	5.1	5.3	8.3	6.6	6.5	5.72	5.9
11	5.3	5.4	5.2	6.1	5.5	5.05	5.1	10.0	6.3	6.4	5.9	5.9
12	6.0	5.3	5.2	6.0	5.5	5.0	5.0	7.5	6.2	6.32	5.85	5.85
13	5.85	5.3	5.2	5.9	5.4	5.0	4.91	7.15	6.12	6.2	5.8	5.8
14	5.8	5.3	5.3	5.95	5.4	5.01	5.9	6.81	6.05	6.2	5.9	5.75
15	5.6	5.3	5.35	5.95	5.4	5.1	6.12	6.4	6.0	6.05	5.85	5.7
16	5.8	5.25	5.32	5.85	5.5	5.15	5.7	6.2	5.9	6.0	5.85	5.7
17	5.7	5.25	5.4	5.81	5.4	5.5	5.5	6.2	6.0	6.0	5.85	5.7
18	5.6	5.22	5.4	5.8	5.4	5.45	5.3	6.3	5.8	9.2	6.0	5.7
19	5.6	5.3	5.4	5.75	5.35	5.2	5.21	6.25	5.7	6.7	6.7	5.7
20	5.9	5.25	5.4	5.85	5.3	5.15	5.15	6.1	5.7	6.4	6.4	6.0
21	6.1	5.35	5.36	5.7	5.3	5.1	5.01	6.1	5.65	6.23	6.2	5.7
22	5.9	5.3	5.35	5.7	5.3	5.1	5.3	5.9	5.7	6.3	6.1	5.7
23	6.0	5.3	5.3	5.65	5.35	5.05	5.4	5.75	6.05	6.2	6.5	6.1
24	5.78	5.27	5.25	6.2	5.6	5.02	5.6	5.7	5.8	6.1	6.25	6.0
25	7.75	5.3	5.4	6.1	5.32	5.05	6.0	5.65	5.7	6.1	6.1	5.9
26	7.2	5.22	5.4	5.95	5.25	5.0	5.9	5.8	5.7	6.1	6.1	5.8
27	6.5	5.22	5.3	6.2	5.25	5.05	5.6	5.7	5.65	6.05	6.0	5.8
28	6.18	5.25	5.3	6.1	5.21	5.01	6.2	5.7	5.6	6.0	6.0	5.75
29	6.0		11.1	6.0	5.2	5.0	5.8	5.6	5.6	6.0	6.2	5.7
30	5.82		9.4	5.9	5.2	4.95	5.65	5.6	5.6	5.95	6.0	5.7
31	5.71		7.7		5.1		6.2	5.6		5.9		5.9
1899.												
1	5.8	5.6	6.9	6.8	5.85	5.3	(a)	5.3	5.4	4.9	4.85	5.1
2	5.7	5.7	6.6	6.6	5.82	5.3	(a)	5.2	5.25	4.8	4.9	5.35
3	5.7	5.7	6.7	6.5	5.8	5.3	(a)	5.2	5.5	4.85	4.9	5.1
4	5.65	14.0	6.32	7.2	5.8	5.25	(a)	5.15	5.3	4.75	4.9	5.1
5	5.6	9.6	7.4	6.55	6.1	5.25	(a)	5.12	5.2	4.8	4.9	5.1

a No readings July 1 to 8; gage broken.

Daily gage height, in feet, of Hiwassee River at Murphy, N. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
6	5.7	9.45	6.75	6.5	5.8	5.25	(a)	5.2	5.1	4.9	4.9	5.02
7	6.3	9.9	6.5	6.55	5.85	5.1	(a)	5.2	5.1	4.9	4.9	5.0
8	6.0	7.85	6.4	6.7	5.7	5.1	5.2	5.2	5.15	5.7	4.9	5.1
9	5.9	7.2	6.4	6.6	5.7	5.2	5.1	5.12	5.05	5.15	4.9	5.05
10	5.8	6.75	6.3	6.5	5.7	5.15	5.1	5.15	5.0	5.0	4.9	5.1
11	5.8	6.6	6.2	6.4	5.62	5.1	5.05	5.15	5.2	5.02	4.9	5.1
12	5.8	6.55	6.1	6.3	5.62	5.82	5.0	5.1	5.1	5.0	4.85	9.1
13	5.7	6.3	6.1	6.2	5.6	5.8	5.0	5.1	5.0	4.9	4.85	6.3
14	5.7	6.4	6.75	6.2	5.55	5.5	5.0	5.05	5.0	4.8	4.9	5.82
15	5.75	6.4	10.8	6.1	5.6	5.35	5.0	5.2	5.0	5.0	4.9	5.7
16	5.75	6.3	8.75	6.1	5.5	5.25	5.0	5.32	4.9	5.0	4.9	5.5
17	5.75	6.25	7.5	6.05	5.5	5.3	5.1	5.2	5.0	5.0	4.9	5.4
18	5.7	6.25	7.1	6.0	5.5	5.2	5.3	5.1	5.0	4.95	4.9	5.4
19	5.7	6.0	18.4	6.0	5.6	5.2	5.2	5.0	5.0	5.1	4.85	5.3
20	5.7	6.1	8.7	6.0	5.5	5.15	5.1	5.0	5.1	5.0	4.85	5.5
21	5.7	6.1	7.6	6.0	5.45	5.1	5.3	5.0	5.0	5.0	4.9	5.4
22	5.6	6.1	7.2	5.9	5.4	5.1	5.3	5.0	5.0	4.9	4.9	5.35
23	5.6	6.0	8.15	5.9	5.4	5.1	5.3	5.0	5.0	4.9	5.4	5.3
24	5.52	5.92	7.0	5.9	5.42	4.85	5.2	5.0	5.0	4.9	5.12	6.3
25	5.65	6.1	6.8	6.7	5.4	4.95	5.2	5.1	5.0	4.9	5.1	5.7
26	5.6	6.0	6.6	6.1	5.4	5.05	6.8	5.05	5.0	4.9	5.75	5.6
27	5.6	9.1	6.52	6.0	5.35	5.0	5.75	5.25	5.02	4.9	5.4	5.5
28	5.6	7.3	6.5	6.0	5.35	5.0	5.9	5.45	5.0	5.0	5.3	5.55
29	5.5	.....	6.9	5.9	5.32	5.0	.....	5.1	5.0	5.1	5.2	5.5
30	5.5	.....	6.7	5.9	5.32	5.0	.....	5.1	4.88	4.9	5.1	5.35
31	5.9	.....	7.8	.....	5.3	.....	.....	5.7	.....	5.0	.....	5.4
1900.												
1	5.5	5.12	7.0	5.9	6.1	5.4	6.8	5.8	5.35	5.0	5.2	5.4
2	5.2	5.3	6.5	5.9	6.0	5.4	6.6	5.4	5.2	4.9	5.25	5.45
3	5.51	5.35	6.25	5.9	6.0	5.6	7.0	5.4	5.15	5.0	6.2	5.4
4	5.3	5.4	6.1	6.7	5.9	5.8	6.4	5.4	5.1	5.1	5.6	7.2
5	5.3	5.6	6.0	6.1	5.9	5.5	6.2	5.3	5.2	5.1	5.4	6.4
6	5.2	5.4	6.0	6.05	5.8	6.1	6.0	5.3	5.15	5.05	5.35	6.0
7	5.2	5.4	7.0	6.0	5.7	6.0	5.9	5.3	5.1	5.0	5.35	5.8
8	5.2	5.4	7.5	5.9	5.7	6.1	5.8	5.2	5.05	5.3	5.3	5.75
9	5.2	6.72	7.4	5.85	5.7	6.1	6.2	5.2	5.05	5.1	5.25	5.6
10	5.2	6.02	6.9	5.8	5.7	6.3	5.7	5.2	5.0	5.05	5.25	5.6
11	5.3	6.1	6.6	6.1	5.7	6.1	5.7	5.2	5.0	5.0	5.2	5.5
12	6.3	6.1	6.4	6.3	5.65	6.1	5.8	5.2	5.0	4.9	5.25	5.5
13	5.8	12.6	6.3	6.1	5.6	6.6	5.8	5.2	5.0	5.3	5.2	5.45
14	5.6	7.7	6.12	6.0	5.6	6.1	5.7	5.2	5.05	5.1	5.25	5.45
15	5.6	7.15	6.05	6.0	5.6	5.8	5.6	5.2	7.0	5.0	5.2	5.4
16	5.5	6.5	6.3	5.9	5.5	5.8	5.6	5.1	6.45	5.0	5.15	5.4
17	5.4	6.2	6.0	5.8	5.4	6.2	5.6	5.3	5.7	4.9	5.2	5.4
18	5.45	5.9	6.0	6.2	5.5	6.0	5.6	5.2	5.45	4.8	5.15	5.3
19	5.9	5.9	6.85	6.7	5.7	6.3	5.5	5.1	5.35	5.0	5.2	5.3
20	6.6	5.8	7.4	6.4	5.5	6.1	5.5	5.1	5.35	4.9	5.15	5.8
21	6.2	6.0	6.9	7.1	5.4	5.9	5.5	5.1	5.25	4.9	5.2	6.7
22	5.9	6.4	6.6	6.8	5.4	5.8	5.6	5.1	5.0	5.0	5.3	5.9
23	5.8	6.15	6.4	6.7	5.4	6.3	5.7	5.3	5.4	4.9	5.2	5.8
24	5.65	6.0	6.35	6.5	5.6	6.6	5.6	5.9	5.2	7.1	5.15	6.0
25	5.6	6.0	6.4	6.55	5.5	6.5	5.4	5.3	5.2	6.0	5.3	5.8
26	5.6	6.0	6.4	6.55	5.6	7.0	5.5	5.4	5.2	5.7	6.7	5.7
27	5.5	5.9	6.3	6.3	5.5	7.2	5.7	5.2	5.15	5.6	6.0	5.65
28	5.4	5.85	6.3	6.2	5.5	7.1	5.9	5.15	5.15	5.4	5.7	5.6
29	5.4	.....	6.05	6.2	5.4	7.0	5.7	5.15	5.1	5.3	5.6	5.7
30	5.4	.....	6.1	6.1	5.4	6.8	5.8	5.15	5.05	5.2	5.5	.....
31	5.5	.....	6.0	.....	5.4	.....	5.6	5.15	.....	5.25	.....	.....
1901.												
1	6.0	6.05	5.6	6.35	6.15	6.35	6.0	5.3	6.7	5.6	5.25	5.2
2	5.9	5.95	5.6	7.65	6.1	6.2	5.9	5.25	6.4	5.6	5.25	5.2
3	5.8	5.9	5.55	7.6	6.05	6.1	5.65	5.2	6.25	5.6	5.25	5.3
4	5.7	7.55	5.55	7.1	6.0	6.05	5.6	5.2	6.2	5.5	5.3	5.35
5	5.6	6.75	5.7	6.75	6.0	6.0	5.55	5.2	6.15	5.5	5.3	5.2
6	5.6	6.4	5.6	6.75	6.05	5.95	5.7	7.65	6.05	5.5	5.3	5.25
7	5.6	6.25	5.55	6.5	5.95	6.1	6.55	7.0	6.0	5.45	5.25	5.2
8	5.5	6.15	5.55	6.4	5.85	5.9	5.75	6.05	5.9	5.4	5.25	5.25
9	5.5	6.95	5.55	6.25	5.85	5.85	5.55	5.75	5.85	5.45	5.25	5.25
10	5.5	6.5	5.6	6.2	5.85	5.8	5.5	5.6	5.8	5.4	5.25	6.15

a No readings July 1 to 8; gage broken.

Daily gage height, in feet, of Hiwassee River at Murphy, N. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1901.												
11	8.8	6.4	6.5	6.1	5.8	5.8	5.45	5.85	6.0	5.4	5.25	5.5
12	9.2	6.3	6.1	6.1	5.75	5.95	5.45	6.55	5.8	5.4	5.2	5.4
13	7.5	6.25	5.95	6.15	5.75	5.85	5.4	5.75	6.0	6.2	5.4	5.4
14	6.85	6.15	5.85	6.55	5.7	6.5	5.4	7.95	5.8	5.5	5.3	6.2
15	6.5	6.05	5.75	6.35	5.65	6.5	5.45	7.3	5.7	5.45	5.2	9.1
16	6.3	6.0	5.75	6.2	5.65	6.35	5.8	7.9	5.9	5.4	5.2	6.9
17	6.2	5.9	5.7	6.15	5.65	6.3	5.4	8.15	7.2	5.4	5.2	6.7
18	6.1	5.85	5.65	6.1	5.6	6.1	5.4	8.45	6.75	5.4	5.25	6.6
19	5.9	5.85	5.6	6.55	6.7	6.0	7.1	7.35	6.2	5.4	5.25	5.9
20	5.85	5.8	5.6	11.4	7.2	6.05	5.65	7.05	6.0	5.35	5.25	5.8
21	5.85	5.75	5.95	7.9	7.5	5.85	5.45	8.15	5.9	5.35	5.2	5.7
22	5.9	5.75	5.75	7.25	10.6	5.8	5.65	8.0	5.8	5.35	5.2	5.75
23	5.8	5.75	5.65	6.95	7.75	5.75	5.4	12.7	5.75	5.35	5.25	5.7
24	6.05	5.7	5.95	6.7	7.1	5.7	5.35	8.25	5.7	5.3	5.45	5.9
25	5.9	5.65	5.8	6.65	6.85	5.7	5.45	7.35	5.65	5.3	5.3	5.85
26	5.85	5.7	10.8	6.5	6.55	6.1	5.3	6.95	5.65	5.3	5.2	5.8
27	5.9	5.65	8.2	6.4	6.5	5.7	5.65	6.75	5.6	5.3	5.2	7.3
28	6.05	5.6	7.2	6.35	6.35	6.2	5.3	6.85	5.6	5.3	5.15	8.2
29	5.95	.....	6.8	6.2	6.35	6.05	5.5	7.0	5.75	5.3	5.15	11.3
30	6.0	.....	6.6	6.15	6.2	5.75	5.35	6.8	5.6	5.3	5.2	9.1
31	6.2	.....	6.5	.....	6.75	.....	5.5	6.7	.....	5.25	.....	7.5
1902.												
1	6.95	7.8	8.5	6.6	5.7	5.3	5.2	4.9	4.75	5.25	4.9	5.6
2	6.6	9.1	7.5	6.5	5.8	5.3	5.2	4.9	4.8	5.15	4.9	5.5
3	6.15	7.5	7.05	6.35	5.7	5.3	5.15	5.2	4.8	5.05	4.9	5.6
4	6.3	6.9	6.8	6.3	5.65	5.25	5.15	4.95	5.15	5.0	4.9	5.6
5	6.15	6.5	7.15	6.25	5.7	5.25	5.15	4.9	4.95	5.05	4.9	5.5
6	6.1	6.35	6.8	6.15	5.7	5.2	5.15	4.85	4.85	5.1	5.9	5.6
7	6.0	6.25	6.55	6.15	5.6	5.2	5.3	4.85	4.8	5.0	5.2	5.5
8	5.95	6.15	6.45	6.65	5.6	5.55	5.15	4.85	4.8	5.0	5.1	5.6
9	5.9	6.5	6.75	6.35	5.6	5.55	5.1	4.8	4.8	5.0	5.0	5.4
10	5.85	6.0	6.55	6.25	5.5	5.55	5.1	4.8	5.35	4.95	5.05	5.4
11	5.85	5.9	6.5	6.15	5.5	5.5	5.1	4.85	4.95	5.0	5.0	5.35
12	5.8	5.9	6.4	6.1	5.55	5.5	5.5	4.8	4.9	5.45	5.0	5.3
13	5.75	5.85	6.65	6.05	5.55	5.5	5.4	4.8	5.05	5.15	5.0	5.35
14	5.7	5.8	6.45	6.0	5.55	5.45	5.25	4.8	5.05	5.45	5.0	5.35
15	5.7	5.85	6.4	6.0	5.5	5.5	5.3	4.85	4.9	5.15	4.95	5.35
16	5.7	5.9	6.45	6.0	5.55	5.5	5.2	4.8	4.9	5.1	4.95	5.75
17	5.65	5.85	6.9	5.95	5.5	5.45	5.15	4.85	4.85	5.05	5.0	6.15
18	5.65	5.75	6.6	6.0	5.55	5.4	5.1	4.8	4.85	5.0	5.5	5.9
19	5.9	5.75	6.45	5.95	5.5	5.4	5.1	4.8	4.95	4.95	5.15	5.6
20	5.7	5.8	6.35	5.9	5.4	5.4	5.05	4.8	5.35	4.95	5.05	5.5
21	5.65	6.05	6.3	5.85	5.4	5.35	5.05	4.8	5.05	4.95	5.05	5.4
22	5.75	6.25	6.25	5.8	5.35	5.4	5.05	4.75	5.0	4.95	5.0	6.3
23	5.65	6.05	6.2	5.8	5.45	5.3	5.05	4.75	4.95	4.95	5.05	5.9
24	5.65	6.0	6.15	5.75	5.4	5.3	5.0	4.75	4.9	4.95	5.0	5.75
25	5.6	6.05	6.1	5.75	5.5	5.25	5.0	4.75	5.45	4.9	5.5	5.7
26	5.6	6.05	6.05	5.75	5.3	5.5	4.95	4.75	5.15	4.9	6.0	5.6
27	5.65	6.0	6.1	5.75	5.3	5.55	4.9	4.85	5.35	4.95	5.7	5.4
28	5.95	14.15	6.1	5.75	5.25	5.45	4.9	4.95	5.45	4.95	5.5	5.6
29	6.05	.....	10.9	5.7	5.25	5.3	4.9	4.9	5.15	4.9	5.4	5.4
30	6.1	.....	7.5	5.9	5.3	5.25	4.9	4.85	5.05	4.9	5.4	5.75
31	7.2	.....	6.9	.....	5.35	.....	4.9	4.8	.....	4.9	.....	5.5
1903.												
1	5.05	5.4	8.55	7.1	6.0	6.2	5.4	5.25	4.95	4.85	4.95	4.9
2	5.05	5.4	7.35	6.85	5.95	6.25	5.5	6.5	4.95	4.85	4.9	4.9
3	5.05	5.5	6.95	6.7	5.9	5.9	5.45	5.7	5.0	4.85	4.9	4.9
4	5.85	6.6	6.75	6.95	6.3	5.75	5.4	5.3	5.0	4.9	4.95	4.9
5	5.8	6.9	6.55	6.55	5.85	6.4	5.35	6.15	5.0	4.85	5.4	4.9
6	5.7	6.25	6.6	6.45	5.85	6.75	5.45	5.4	4.95	4.85	5.05	4.9
7	5.6	6.25	6.45	6.4	5.8	6.35	5.65	5.3	4.9	4.85	4.95	4.85
8	5.6	7.6	7.95	6.7	5.8	6.5	5.45	5.2	4.9	5.9	4.95	4.85
9	5.5	6.9	7.75	6.8	5.75	5.9	5.4	5.15	5.05	5.05	4.9	4.85
10	5.5	6.45	7.35	6.55	5.75	5.85	5.65	5.1	4.95	4.9	4.9	4.9
11	5.55	7.2	9.95	6.45	5.7	6.3	5.5	5.2	4.9	4.85	4.9	4.9
12	5.95	7.35	8.2	6.3	5.7	5.9	6.15	5.1	4.9	4.85	5.15	4.9
13	5.7	6.75	7.5	6.5	5.75	5.75	6.1	5.0	4.9	4.85	5.0	4.85
14	5.7	6.45	7.1	7.05	5.7	5.65	6.1	5.0	4.9	4.85	4.95	5.05
15	5.6	6.25	6.85	7.25	5.7	5.65	5.7	5.1	5.15	4.85	5.0	4.95

ily gage height, in feet, of Hiwassee River at Murphy, N. C.—Continued.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
.....	5.55	6.2	6.7	6.9	5.65	5.6	5.55	5.15	5.45	4.85	4.95	4.9
.....	5.6	9.15	6.55	6.7	5.6	5.55	5.75	5.2	5.1	4.95	5.0	4.85
.....	5.9	7.3	6.45	6.55	5.6	5.5	5.5	5.2	5.05	5.05	5.45	4.85
.....	5.4	6.75	6.35	6.45	5.55	5.5	5.45	5.1	4.95	4.9	5.0	4.85
.....	5.35	6.5	6.25	6.4	5.55	5.5	5.45	5.2	4.95	4.9	5.0	5.05
.....	5.4	6.35	6.9	6.45	6.1	5.65	5.35	5.1	4.95	4.9	5.0	5.25
.....	5.35	6.2	7.1	6.25	5.55	5.45	5.35	5.1	4.95	4.85	4.95	5.0
.....	5.35	6.05	11.8	6.2	5.5	5.5	5.35	5.05	4.9	4.85	4.95	5.0
.....	5.35	6.0	8.75	6.15	5.5	5.45	5.3	5.05	4.9	4.9	4.95	4.95
.....	5.4	5.95	7.65	6.1	5.45	5.4	5.25	5.05	4.9	4.85	4.95	4.95
.....	5.35	5.85	7.15	6.25	5.45	5.45	5.25	5.0	4.85	4.85	4.95	5.0
.....	5.5	5.8	6.9	6.1	5.45	5.75	5.25	5.0	4.9	4.85	4.95	4.95
.....	5.35	12.0	6.75	6.05	5.45	5.85	5.25	5.0	4.9	4.85	4.9	5.05
.....	5.55	.....	6.65	6.0	5.95	5.55	5.3	4.95	4.9	4.85	4.9	5.0
.....	5.45	.....	7.85	5.95	5.6	5.45	5.35	4.95	4.85	4.9	4.9	4.95
.....	5.4	.....	7.55	.....	5.8	.....	5.4	4.95	.....	4.95	.....	4.95
.....	4.9	5.15	5.5	5.75	5.45	5.5	5.25	5.5	5.2	4.8	4.75	5.15
.....	4.9	5.1	5.5	5.7	5.4	5.35	5.1	5.2	5.1	4.8	4.75	5.0
.....	5.05	5.25	5.55	5.6	5.45	5.3	5.1	5.05	5.05	4.8	4.8	5.55
.....	4.95	5.1	5.55	5.55	5.45	5.25	5.05	5.05	5.3	4.8	5.0	5.15
.....	4.9	5.1	5.45	5.55	5.5	5.2	5.45	5.05	5.55	4.8	4.95	5.15
.....	4.85	5.1	5.4	5.5	5.45	5.15	5.1	5.65	5.15	4.8	4.9	5.95
.....	5.0	5.15	7.8	5.95	5.4	6.85	5.1	5.15	5.1	4.8	4.8	5.4
.....	4.85	6.0	6.6	6.5	5.55	5.65	5.05	5.85	5.05	4.8	4.8	5.15
.....	4.9	5.5	6.15	5.95	5.55	5.35	6.15	5.45	5.0	4.75	4.8	5.1
.....	4.9	5.45	5.9	6.05	6.05	5.25	5.25	5.25	5.0	4.75	4.8	5.15
.....	4.95	5.4	6.0	5.95	5.8	5.25	5.1	5.65	5.0	4.75	4.8	5.15
.....	5.05	5.35	5.75	5.8	5.7	5.35	5.1	5.45	4.95	4.75	4.8	5.0
.....	5.05	5.25	5.7	5.7	5.6	5.2	5.25	5.5	4.95	4.75	5.0	5.05
.....	5.1	5.2	6.25	5.65	5.55	5.15	5.1	5.25	4.95	4.75	5.0	5.05
.....	5.0	5.6	6.0	5.6	5.55	5.15	5.0	7.25	4.95	4.75	5.0	5.0
.....	5.0	5.4	5.75	5.65	5.45	5.1	5.0	5.45	4.9	4.75	4.9	5.0
.....	5.7	5.3	5.7	5.55	5.45	5.1	5.35	5.25	4.9	4.75	4.8	5.05
.....	5.35	5.25	5.65	5.55	5.45	5.1	5.35	5.15	4.9	4.75	4.8	5.05
.....	5.2	5.25	5.6	5.5	5.4	5.1	5.0	5.1	4.85	4.75	4.85	5.05
.....	5.15	6.05	5.5	5.45	5.35	5.65	4.95	5.45	4.85	4.75	4.85	5.0
.....	5.1	5.7	5.5	5.6	5.35	5.3	4.95	5.2	4.95	4.75	4.8	4.95
.....	5.2	6.55	6.5	5.45	5.3	5.2	5.2	5.1	4.9	4.75	4.9	4.95
.....	6.3	6.4	7.4	5.4	5.3	5.15	5.05	5.1	4.9	4.7	4.9	4.95
.....	5.7	6.0	7.35	5.4	5.3	5.1	5.05	5.5	4.85	4.75	4.95	5.0
.....	5.45	5.75	6.5	5.4	5.25	5.05	5.15	5.35	4.85	4.75	4.85	5.25
.....	5.35	5.6	6.35	5.4	5.25	5.25	5.0	5.1	4.85	4.75	4.85	5.15
.....	5.25	5.6	6.35	5.75	5.25	5.6	4.95	5.6	4.85	4.75	4.85	5.1
.....	5.2	5.5	6.1	5.6	5.2	5.1	4.95	5.3	4.85	4.8	4.8	6.45
.....	5.2	5.45	6.0	5.55	5.2	5.85	5.05	5.15	4.85	4.8	4.8	5.65
.....	5.05	.....	5.9	5.5	5.2	5.3	5.2	5.1	4.85	4.8	5.25	5.4
.....	5.20	.....	5.8	.....	6.1	.....	4.95	5.1	.....	4.75	.....	5.3
.....	5.25	5.3	5.8	5.55	6.3	5.7	5.85	5.2	5.15	5.0	5.0	5.2
.....	5.2	5.25	5.8	5.55	6.05	5.65	6.0	5.2	5.25	4.95	5.0	5.15
.....	5.45	5.2	5.7	5.5	5.9	5.55	5.45	5.15	5.3	5.0	5.0	10.0
.....	5.4	5.2	5.6	5.5	5.9	5.55	5.35	5.15	5.2	5.5	5.0	6.5
.....	5.35	5.2	5.6	5.65	5.8	5.5	5.65	5.2	5.15	5.1	5.0	5.9
.....	5.35	5.95	5.6	5.65	6.1	5.5	5.4	5.15	5.1	5.0	5.0	5.65
.....	5.8	5.75	5.6	5.7	6.2	5.5	5.45	5.15	5.1	5.0	5.1	5.55
.....	5.5	5.7	5.6	5.6	6.7	5.45	5.35	5.35	5.1	5.0	5.0	5.55
.....	5.45	8.75	5.6	5.7	6.05	5.4	5.35	5.35	5.1	4.95	5.0	8.7
.....	5.4	6.95	6.1	5.65	5.9	5.4	6.35	5.25	5.05	5.0	5.0	7.0
.....	5.4	6.3	6.0	5.6	5.8	5.35	6.55	6.3	5.15	7.55	5.0	6.35
.....	5.5	6.1	5.8	5.85	5.75	5.4	10.3	5.8	5.15	5.45	5.0	6.05
.....	6.6	7.0	5.8	5.85	5.9	5.35	6.85	5.75	5.1	5.2	5.0	5.85
.....	6.55	6.3	5.7	5.75	5.7	5.4	6.15	6.3	5.1	5.1	5.0	5.75
.....	6.6	6.3	5.6	5.7	5.65	5.3	5.85	5.9	5.05	5.1	5.0	5.85
.....	5.8	6.0	5.6	5.8	7.2	5.4	5.8	5.75	5.05	5.2	5.0	5.8
.....	5.65	5.9	5.6	5.7	6.45	5.5	5.65	5.6	5.05	5.1	5.0	5.7
.....	5.6	5.8	5.6	5.65	6.1	5.4	5.55	5.5	5.0	5.05	5.0	5.65
.....	5.5	5.7	5.55	5.6	5.95	5.6	5.6	5.45	5.0	5.05	5.0	5.6
.....	5.6	6.2	5.65	5.55	5.85	5.5	5.5	5.4	5.0	5.05	5.35	5.65

Daily gage height, in feet, of Hiwassee River at Murphy, N. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1905.											
21	5.45	8.2	7.0	5.55	5.8	5.5	5.4	5.35	5.0	5.05	5.15
22	5.4	7.2	6.25	5.65	5.85	5.8	5.5	5.3	5.0	5.0	5.1
23	5.35	6.6	6.05	5.5	6.45	6.75	5.4	5.25	5.0	5.0	5.05
24	5.35	6.4	5.9	5.5	6.95	5.55	5.35	6.5	4.95	5.0	5.0
25	5.3	6.2	5.85	5.45	6.35	5.55	5.4	5.5	4.95	5.0	5.15
26	5.25	6.1	5.75	5.5	6.2	5.35	5.3	5.6	4.95	5.3	5.2
27	5.25	6.0	5.7	5.9	6.1	5.35	5.3	5.35	4.95	5.15	5.1
28	5.2	5.9	5.65	5.8	5.95	5.45	5.35	5.3	4.95	5.1	5.1
29	5.15	.....	5.65	5.7	5.85	5.4	5.45	5.25	4.95	5.05	5.1
30	5.3	.....	5.65	6.95	5.8	5.55	5.3	5.2	4.95	5.05	5.2
31	5.2	.....	5.6	.....	5.95	.....	5.25	5.2	.....	5.0	.....

Rating tables for Hiwassee River at Murphy, N. C.

OCTOBER 20, 1897, TO DECEMBER 31, 1898, AND JANUARY 1 TO DECEMBER 31, 1901.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.70	220	4.90	300	5.00	340	5.10	390
4.80	260						

JANUARY 1 TO DECEMBER 31, 1899.[b]

4.70	252	5.70	884	7.40	3,660	13.00	13,180
4.80	280	5.80	1,016	7.60	4,000	14.00	14,880
4.90	310	5.90	1,148	7.80	4,340	15.00	16,580
5.00	340	6.00	1,280	8.00	4,680	16.00	18,280
5.10	396	6.20	1,620	8.50	5,530	17.00	19,980
5.20	452	6.40	1,960	9.00	6,380	18.00	21,680
5.30	508	6.60	2,300	9.50	7,230	19.00	23,380
5.40	564	6.80	2,640	10.00	8,080		
5.50	620	7.00	2,980	11.00	9,780		
5.60	752	7.20	2,320	12.00	11,480		

JANUARY 1 TO DECEMBER 31, 1900.[c]

4.80	310	5.60	861	6.40	2,025	7.40	3,775
4.90	362	5.70	977	6.50	2,200	7.60	4,125
5.00	415	5.80	1,093	6.60	2,375	7.80	4,475
5.10	481	5.90	1,209	6.70	2,550	8.00	4,825
5.20	547	6.00	1,325	6.80	2,725	8.50	5,700
5.30	613	6.10	1,500	6.90	2,900		
5.40	679	6.20	1,675	7.00	3,075		
5.50	745	6.30	1,850	7.20	3,425		

JANUARY 1, 1902, TO DECEMBER 31, 1903.[d]

4.80	205	5.90	1,070	7.00	3,000	8.50	5,700
4.90	265	6.00	1,200	7.10	3,180	9.00	6,600
5.00	325	6.10	1,380	7.20	3,360	9.50	7,500
5.10	385	6.20	1,560	7.30	3,540	10.00	8,400
5.20	450	6.30	1,740	7.40	3,720	11.00	10,200
5.30	520	6.40	1,920	7.50	3,900	12.00	12,000
5.40	590	6.50	2,100	7.60	4,080	13.00	13,800
5.50	670	6.60	2,280	7.70	4,260	14.00	15,600
5.60	750	6.70	2,460	7.80	4,440		
5.70	845	6.80	2,640	7.90	4,620		
5.80	940	6.90	2,820	8.00	4,800		

[a] Above gage height 5.10 feet use the 1902 rating table.
[b] Above 6.0 feet the rating curve is a tangent, the difference being 170 per tenth.
[c] Above gage height 8.5 feet use the rating table for 1901–1903.
[d] Above gage height 6.0 feet the rating curve is a tangent, the difference being 180 per tenth.

Rating tables for Hiwassee River at Murphy, N. C.—Continued.

JANUARY 1, 1904, TO DECEMBER 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.70	150	5.60	710	6.50	1,850	7.40	3,540
4.80	190	5.70	800	6.60	2,020	7.50	3,750
4.90	235	5.80	900	6.70	2,190	7.60	3,960
5.00	285	5.90	1,010	6.80	2,370	7.80	4,400
5.10	340	6.00	1,130	6.90	2,550	8.00	4,840
5.20	400	6.10	1,260	7.00	2,740	9.00	7,040
5.30	470	6.20	1,400	7.10	2,930	10.00	9,240
5.40	540	6.30	1,540	7.20	3,130		
5.50	620	6.40	1,690	7.30	3,330		

a table is based on 62 discharge measurements made during 1900–1905. It is well defined between ights 4.8 feet and 6.8 feet. The table has been extended beyond these limits. Above 7.6 feet ing curve is a tangent, the difference being 220 per tenth.

Estimated monthly discharge of Hiwassee River at Murphy, N. C.

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1897.[a]					
ır 20–31	340	200	243	0.593	0.265
ıber	590	300	344	.839	.936
ber	3,630	340	829	2.02	2.33
1898.[a]					
ry	4,350	390	1,049	2.56	2.95
ary	768	464	557	1.36	1.42
	10,400	450	1,171	2.86	3.30
	6,150	795	1,542	3.76	4.20
	940	390	630	1.54	1.78
	670	320	397	.968	1.08
	1,560	300	667	1.63	1.88
t	8,400	750	2,306	5.62	6.48
ıber	15,500	590	2,659	6.49	7.24
ır	16,300	670	2,677	6.53	7.53
ıber	2,460	860	1,240	3.02	3.37
ber	1,380	840	1,031	2.51	2.89
The year	16,300	300	1,327	3.24	44.12
1899.					
ry	1,790	620	878	2.14	2.47
ary	14,880	720	3,088	7.53	7.84
	22,360	1,450	3,715	9.06	10.45
	3,320	1,120	1,744	4.25	4.74
	1,450	460	719	1.75	2.02
	970	295	440	1.07	1.19
to 28	2,640	340	556	1.36	1.06
t	840	340	404	.99	1.14
ıber	620	310	373	.91	1.01
ır	840	265	339	.83	.95
ıber	905	295	356	.87	.97
ber	6,550	340	800	1.95	2.25
1900.[b]					
ry	2,375	535	858	2.09	2.41
ary	13,080	475	1,829	4.46	4.64
	3,950	1,325	2,141	5.22	6.01
	3,250	1,030	1,717	4.19	4.67
	1,500	670	877	2.14	2.47
	3,[illegible]95	670	1,702	4.15	4.63
	3,075	670	1,170	2.85	3.29
t	1,165	475	588	1.43	1.65
ıber	3,075	415	664	1.62	1.81
ır	3,250	310	596	1.45	1.67
ıber	2,550	505	725	1.77	1.98
ber	3,425	600	1,043	2.54	2.93
The year	13,080	310	1,159	2.83	38.16

[a] Revised estimates.
[b] Low-water estimates for 1900 are probably a few per cent too high.

Estimated monthly discharge of Hiwassee River at Murphy, N. C.—Continued

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches
1901.					
January	6,660	670	1,599	3.90	4.4
February	3,990	750	1,429	3.49	3.6
March	9,840	710	1,554	3.79	4.3
April	10,920	1,380	2,535	6.18	6.9
May	9,480	750	1,941	4.73	5.4
June	2,100	840	1,265	3.09	3.4
July	3,180	520	829	2.02	2.3
August	13,260	450	3,068	7.48	8.6
September	3,360	750	1,254	3.06	3.4
October	1,560	485	627	1.53	1.7
November	630	420	484	1.18	1.3
December	14,340	450	1,976	4.82	5.5
The year	14,340	420	1,547	3.77	51.2
1902.					
January	3,360	750	1,303	2.93	3.3
February	15,870	892	2,259	5.51	5.7
March	10,020	1,290	2,582	6.30	7.3
April	2,370	845	1,331	3.25	3.6
May	940	485	677	1.65	1.9
June	710	450	587	1.43	1.6
July	670	265	363	.89	1.0
August	450	190	222	.57	.6
September	555	190	336	.82	.9
October	485	265	347	.85	.9
November	1,200	265	450	1.10	1.2
December	2,370	520	834	2.03	2.3
The year	15,870	190	934	2.28	30.8
1903.					
January	1,135	355	698	1.70	1.9
February	12,000	590	2,498	6.09	6.3
March	11,640	1,650	3,708	9.04	10.4
April	4,170	1,135	2,143	5.23	5.8
May	1,740	630	890	2.17	2.5
June	2,550	590	1,053	2.57	2.8
July	1,470	485	695	1.70	1.9
August	2,100	295	500	1.22	1.4
September	630	235	304	.74	.8
October	1,070	235	280	.68	.7
November	630	265	320	.78	.9
December	485	235	290	.71	.8
The year	12,000	235	1,115	2.72	36.8
1904.					
January	1,540	212	401	.978	1.1
February	1,935	340	671	1.64	1.7
March	4,400	540	1,303	3.17	3.6
April	1,850	540	777	1.90	2.1
May	1,260	400	605	1.48	1.7
June	2,460	312	532	1.30	1.4
July	1,330	260	380	.927	1.0
August	3,230	312	573	1.40	1.6
September	665	212	282	.688	.7
October	190	150	176	.429	.4
November	435	170	224	.546	.6
December	1,770	260	438	1.07	1.2
The year	4,400	150	530	1.29	17.6
1905.					
January	2,020	370	695	1.70	1.9
February	6,600	400	1,602	3.91	4.0
March	2,740	665	907	2.21	2.5
April	2,645	580	815	1.99	2.2
May	3,130	755	1,282	3.13	3.6
June	2,280	470	664	1.62	1.8
July	10,500	435	1,102	2.69	3.1
August	1,850	370	647	1.58	1.8
September	470	260	307	.749	.8
October	3,855	260	449	1.10	1.2
November	505	285	316	.771	.8
December	9,550	370	1,518	3.70	4.2
The year	10,500	260	859	2.10	28.3

NOTTELY RIVER AT RANGER, N. C.

ı station was established February 16, 1901, by O. P. Hall. It ted at the wooden wagon bridge one-half mile from the railroad ı at Ranger, N. C., and one-fourth mile below the Atlanta, Knox- nd Northern Railroad bridge.

bridge is at a flat bend in the river, the channel curving slightly and below the station for 600 feet. The right bank is high, and somewhat wooded and will overflow around the end of the for about 50 feet only. The left bank is low and will overflow listance of 700 feet at a gage height of from 15 to 18 feet. The the stream is of gravel and sand and probably shifts considera- The current is somewhat broken and irregular, mostly because piers. There is a moderate velocity and a depth of from 2 to 5 t low stages. Discharge measurements are made from the . bridge, a wooden structure of 3 spans supported by 2 wooden .nd 2 stone abutments. The center span is 55 feet long, and the ›ans are each 36 feet long. The floor of the bridge is about 20 bove low water. The initial point for soundings is the inside f the stone abutment on the right bank.

gage is a vertical board in two sections, each 8 feet long, fas- to the left side of the first wooden pier from the right bank. age is read once each day by A. D. Kilpatrick. Bench marks stablished as follows: (1) The heads of large wire nails driven ıe top of the downstream end of the wooden cap on the left bent wooden pier nearest the right bank of the river; elevation, 20.05 (2) A cut on a maple tree 18 inches in diameter, 25 feet from stream side of the bridge on the right bank, 25 feet from the edge water; elevation, 15.00 feet.

Discharge measurements of Nottely River at Ranger, N. C.

Date.	Gage height.	Discharge.
1900.	*Feet.*	*Sec.-ft.*
.....	2.40	500
1901.		
r 16.....	4.20	649
.....	5.40	970
.....	4.12	612
31.....	3.40	364
1902.		
.....	4.20	598
4.....	2.70	213
or 21.....	2.75	213
1903.		
.....	4.74	833
.....	3.95	551
.....	3.42	372
1903.		
August 28.....	2.88	267
October 2.....	2.62	183
December 5.....	2.68	204
1904.		
March 1.....	3.40	373
May 14.....	3.35	353
August 30.....	2.75	222
October 7.....	2.30	121
December 16.....	2.58	184
1905.		
April 17.....	3.48	421
June 20.....	3.51	399
June 21.....	3.98	538
October 12.....	3.22	315

Daily gage height, in feet, of Nottely River at Ranger, N. C.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1901.											
1	.....	.....	3.6	4.8	4.4	6.0	5.0	3.5	6.0	4.1	3.
2	.....	.....	3.6	8.8	4.3	4.8	5.2	3.4	5.2	4.0	3.
3	.....	.....	3.6	7.0	4.3	4.6	4.2	3.3	5.0	3.9	3.
4	.....	.....	3.6	5.6	4.2	5.0	4.1	3.2	4.8	3.9	3.
5	.....	.....	3.8	5.2	4.2	4.6	4.0	3.1	5.0	3.8	3.
6	.....	.....	3.7	5.1	4.2	5.4	3.9	9.6	4.8	3.8	3.
7	.....	.....	3.6	4.9	4.1	4.8	4.8	9.2	4.6	4.0	3.
8	.....	.....	3.6	4.7	4.1	4.4	4.6	4.8	4.5	3.9	3.
9	.....	.....	3.8	4.6	4.1	4.2	4.0	4.6	4.8	3.8	3.
10	.....	.....	5.2	4.5	4.0	4.1	3.8	4.2	4.2	3.8	3.
11	.....	.....	5.6	4.3	3.9	4.0	3.7	4.8	4.8	3.7	3.
12	.....	.....	4.2	4.2	3.9	3.9	3.6	4.6	4.4	3.6	3.
13	.....	.....	4.1	5.2	3.8	4.8	3.5	4.8	5.0	4.6	3.
14	.....	.....	4.0	5.0	3.8	7.0	3.5	14.4	4.6	4.0	3.
15	.....	.....	3.9	4.9	3.7	5.6	3.4	9.6	4.4	3.8	3.
16	.....	4.2	3.9	4.7	3.6	5.8	4.0	9.2	5.0	3.7	3.
17	.....	4.1	3.8	4.5	3.6	5.4	3.9	10.0	11.0	3.7	3.
18	.....	4.0	3.8	4.4	3.5	5.6	3.8	10.8	6.2	3.6	3.
19	.....	4.0	3.7	7.8	4.2	4.8	9.8	8.0	5.0	3.6	3.
20	.....	3.9	3.7	8.8	6.4	5.0	4.2	6.8	4.8	3.5	3.
21	.....	3.8	3.6	6.2	11.8	4.6	4.0	10.0	4.6	3.5	3.
22	.....	3.8	3.6	5.7	15.0	4.4	3.8	11.0	4.4	3.5	3.
23	.....	3.7	4.8	5.5	8.5	4.2	3.6	15.8	4.3	3.4	3.
24	.....	3.7	5.4	5.2	5.6	4.1	3.5	8.4	4.2	3.4	4.0
25	.....	3.7	6.2	5.0	5.4	4.0	3.5	6.2	4.1	3.4	3.
26	.....	3.7	13.5	4.8	5.2	5.2	3.4	6.4	4.0	3.3	3.
27	.....	3.7	8.2	4.7	5.0	4.1	3.8	6.4	3.9	3.3	3.
28	.....	3.7	6.2	4.6	4.9	4.0	3.5	6.2	4.2	3.3	3.
29	.....	.....	5.4	4.5	4.8	4.0	3.8	6.0	4.4	3.3	3.
30	.....	.....	5.2	4.4	4.7	4.6	3.6	5.8	4.1	3.4	3.
31	.....	.....	5.2	.....	5.0	.....	3.7	5.6	.....	3.4	.....
1902.											
1	5.5	7.0	9.0	5.0	4.1	3.4	3.0	2.8	2.6	2.9	2.3
2	5.0	7.0	7.2	5.0	4.0	3.3	2.9	2.8	2.6	2.9	2.6
3	5.0	9.1	6.1	5.0	4.0	3.3	2.9	3.0	3.0	2.7	2.6
4	4.5	7.8	6.0	5.0	4.0	3.2	2.8	2.8	3.3	2.7	2.6
5	4.8	5.5	6.3	5.1	4.0	3.2	2.8	2.8	2.8	2.7	2.5
6	4.4	5.0	5.8	5.0	4.0	3.2	2.8	2.8	2.6	2.6	2.5
7	4.4	4.9	5.4	4.8	4.0	3.1	2.8	2.6	2.6	2.6	4.0
8	4.4	4.9	5.3	4.2	3.7	3.8	2.8	2.6	2.5	2.5	4.0
9	4.4	4.5	5.2	5.0	3.7	3.6	2.7	2.6	2.7	2.8	2.8
10	4.3	4.3	5.1	5.0	3.7	3.3	3.0	2.6	2.9	2.7	2.8
11	4.2	4.2	5.1	5.0	3.7	3.2	3.0	3.8	2.6	3.0	2.7
12	4.2	4.1	5.0	4.8	3.6	3.1	3.7	3.6	2.5	2.7	2.7
13	4.0	4.0	6.2	4.4	3.6	3.1	4.4	2.6	3.4	2.9	2.7
14	3.8	4.0	5.0	4.4	4.7	3.1	3.6	2.6	3.0	3.3	2.5
15	3.4	4.0	5.0	4.4	4.6	3.1	4.8	2.6	2.8	3.5	2.5
16	3.4	4.1	6.2	4.4	3.8	3.0	4.3	2.6	2.8	3.0	2.5
17	3.2	4.0	5.2	4.6	3.7	3.0	4.0	2.6	2.7	2.9	2.4
18	3.0	4.0	5.8	4.5	3.7	3.0	3.0	2.6	2.7	2.7	3.7
19	4.0	4.0	5.6	4.4	3.7	3.0	3.0	2.6	3.3	2.9	3.2
20	4.0	4.0	5.0	4.2	3.6	3.0	3.0	2.6	3.0	2.8	3.0
21	4.0	4.1	5.0	4.0	3.6	3.3	2.8	2.4	3.0	2.8	2.9
22	4.0	5.0	4.9	4.1	3.5	3.1	2.8	2.4	2.8	2.7	2.8
23	3.8	4.5	4.8	4.1	3.4	3.0	2.8	2.4	2.6	2.7	2.8
24	3.8	4.4	4.7	4.1	3.3	3.0	2.8	2.5	2.6	2.7	2.7
25	3.8	4.8	4.6	4.1	3.3	3.0	2.7	2.5	2.9	2.6	5.3
26	3.8	4.6	4.6	4.0	3.3	3.6	2.7	2.7	2.7	2.5	4.4
27	4.0	4.8	4.7	4.0	3.3	3.6	2.7	3.0	2.6	2.5	3.7
28	4.4	21.0	4.7	4.0	3.4	3.0	2.7	2.8	3.1	2.5	3.1
29	4.5	.....	13.8	4.2	3.4	3.0	2.8	2.8	3.0	2.4	3.0
30	5.0	.....	6.8	4.3	3.4	3.0	2.8	2.7	3.0	2.4	3.0
31	6.3	.....	5.2	.....	3.4	.....	2.8	2.7	.....	2.3	.....
1903.											
1	3.2	3.2	8.8	6.4	4.2	6.0	3.8	7.0	2.8	2.6	2.7
2	3.2	3.5	6.3	6.1	4.4	7.0	3.7	4.4	2.8	2.5	2.7
3	3.0	3.6	5.8	5.7	4.3	6.0	3.6	3.7	2.7	2.5	2.8
4	4.0	9.6	5.4	5.8	4.2	6.4	3.9	3.6	2.7	2.5	2.9
5	3.8	6.0	5.0	5.3	4.2	7.4	3.6	3.5	2.7	2.6	2.9

Daily gage height, in feet, of Nottely River at Ranger, N. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
6	3.7	4.8	4.9	5.2	4.1	7.0	3.6	3.4	2.9	2.6	2.9	2.6
7	3.7	6.0	5.0	5.1	4.0	7.5	3.7	3.3	2.8	2.6	2.9	2.6
8	3.6	7.6	5.2	5.0	4.0	5.0	3.7	3.2	2.8	4.0	2.9	2.5
9	3.6	5.4	6.7	7.0	4.0	5.0	3.8	3.0	3.2	2.8	2.8	2.5
10	3.8	4.9	6.2	6.5	4.9	4.9	4.0	3.1	2.9	2.7	2.8	2.5
11	3.8	7.6	11.0	5.8	3.9	5.2	3.9	3.4	2.8	2.7	2.7	2.5
12	4.8	7.0	7.6	5.0	3.9	5.2	5.0	3.3	2.8	2.7	3.0	2.5
13	3.8	5.4	6.2	8.6	3.9	5.0	5.8	3.2	2.7	2.6	2.8	2.5
14	3.8	5.0	5.0	8.0	3.9	4.0	5.0	4.0	2.7	2.6	2.7	2.5
15	3.7	4.7	5.4	6.6	3.9	4.0	4.0	4.0	2.7	2.8	2.6	2.5
16	3.6	4.7	5.1	5.8	3.9	4.0	3.9	3.7	2.7	2.8	2.6	2.5
17	3.5	8.0	5.1	5.7	3.8	3.8	4.4	3.3	4.0	2.9	2.8	2.6
18	3.6	5.6	5.0	5.5	3.8	3.8	3.7	3.4	3.2	2.8	4.0	2.6
19	3.5	5.2	4.9	5.4	3.8	3.8	3.6	3.4	2.9	2.7	3.0	2.7
20	3.4	5.0	4.7	5.2	3.8	3.7	4.7	3.3	2.8	2.7	2.8	3.5
21	3.4	4.7	7.0	5.0	4.0	3.7	4.0	3.0	2.9	2.7	2.8	3.4
22	3.3	4.7	8.0	5.2	3.7	3.6	3.5	3.0	2.8	2.7	2.8	3.4
23	3.3	4.6	14.8	4.8	3.5	3.5	3.4	3.2	2.8	2.6	2.7	3.8
24	3.3	4.4	8.0	4.7	3.5	3.5	3.3	3.0	2.7	2.6	2.7	3.7
25	3.4	4.4	6.2	4.6	3.6	3.5	3.0	3.0	2.7	2.6	2.7	3.6
26	3.4	4.3	6.1	4.7	3.6	5.0	3.1	2.9	2.7	2.6	2.6	3.5
27	3.3	4.5	5.6	4.7	3.6	5.0	3.1	2.9	2.7	2.6	2.6	3.4
28	3.4	17.5	5.2	4.6	3.7	4.7	3.1	2.9	2.7	2.5	2.6	3.2
29	3.6	.....	5.0	4.5	3.9	4.0	3.0	2.9	2.6	2.5	2.6	3.1
30	3.7	.....	6.4	4.3	5.5	3.8	3.0	2.9	2.6	2.7	2.5	3.0
31	3.6	.....	7.7	.....	5.7	.....	4.0	2.8	.....	2.7	.....	2.8
1904.												
1	2.8	3.0	3.4	3.8	3.3	3.3	2.9	3.4	2.7	2.3	2.2	2.8
2	2.8	2.9	3.4	3.7	3.3	3.3	2.7	3.0	2.6	2.3	2.2	2.4
3	2.8	2.9	3.3	3.6	3.3	3.0	2.5	2.8	2.6	2.3	2.2	2.4
4	2.7	3.4	3.3	3.5	3.3	2.9	2.4	2.8	2.7	2.2	2.4	2.8
5	2.7	3.2	3.3	3.4	3.3	2.9	2.4	3.6	4.1	2.2	2.3	4.1
6	2.6	3.0	3.2	3.3	3.2	2.8	2.9	3.0	3.0	2.2	2.3	3.6
7	2.8	3.0	8.3	4.2	3.2	7.3	2.7	2.8	2.8	2.2	2.3	3.1
8	2.7	4.5	5.1	5.6	3.3	4.7	2.7	5.0	2.7	2.2	2.3	3.0
9	2.7	3.6	4.5	5.0	4.6	3.7	3.0	3.5	2.6	2.2	2.3	2.9
10	2.6	3.2	4.0	4.5	3.9	3.0	2.8	3.1	2.5	2.2	2.3	2.8
11	2.6	3.3	4.0	4.0	3.7	2.9	2.6	4.0	2.6	2.2	2.3	2.8
12	2.6	3.3	3.8	3.8	3.4	3.0	3.1	3.8	2.6	2.2	2.3	2.8
13	2.5	3.1	3.3	3.7	3.4	2.9	2.2	3.4	2.5	2.2	2.4	2.7
14	2.5	3.0	4.4	3.6	3.3	2.7	2.7	2.9	2.5	2.2	2.4	2.6
15	2.7	3.3	4.0	3.6	3.3	2.7	2.6	3.9	2.4	2.2	2.4	3.0
16	2.8	3.1	3.7	3.5	3.1	2.7	2.4	3.1	2.3	2.2	2.4	2.9
17	4.0	3.0	3.7	3.4	3.1	2.7	2.6	2.9	2.3	2.2	2.4	2.8
18	3.2	3.0	3.7	3.5	3.1	2.7	2.6	2.7	2.3	2.2	2.3	2.7
19	3.8	3.0	3.6	3.5	3.1	2.6	2.5	2.7	2.3	2.2	2.3	2.7
20	3.0	4.8	3.4	3.5	3.1	2.7	2.4	2.7	2.3	2.2	2.3	2.7
21	3.0	3.8	3.3	3.4	3.0	2.9	2.4	2.7	2.2	2.2	2.3	2.7
22	3.0	5.6	5.4	3.4	3.0	3.0	4.2	2.7	2.2	2.2	2.3	2.6
23	5.0	5.0	6.7	3.4	3.0	2.8	2.8	2.6	2.2	2.2	2.3	2.5
24	4.0	4.3	6.4	3.3	2.9	2.7	2.6	3.5	3.0	2.2	2.2	2.7
25	3.8	3.8	5.2	3.3	3.0	2.7	3.1	2.9	2.6	2.2	2.2	2.8
26	3.4	3.7	5.1	3.8	2.9	2.7	2.8	2.8	2.3	2.2	2.2	2.8
27	3.2	3.6	5.0	3.7	2.9	2.8	2.6	2.7	2.3	2.2	2.2	2.8
28	3.0	3.5	4.5	3.7	2.9	3.2	2.8	3.2	2.3	2.2	2.2	4.7
29	3.0	3.3	4.1	3.4	2.9	4.6	2.6	2.7	2.3	2.2	2.2	3.4
30	3.0	.....	4.0	3.4	5.4	3.2	2.6	2.7	2.3	2.2	3.0	3.1
31	2.8	.....	3.9	.....	3.8	.....	2.6	2.7	.....	2.2	.....	3.0
1905.												
1	3.0	2.9	3.7	3.3	3.9	3.5	3.9	2.7	3.4	2.3	2.6	2.6
2	2.9	2.9	3.6	3.3	3.8	3.3	4.1	2.7	3.1	2.3	2.6	2.7
3	3.5	2.9	3.6	3.3	3.7	3.5	3.6	2.7	3.0	2.8	2.7	11.8
4	3.1	3.0	3.6	3.2	3.6	3.4	3.4	2.7	3.0	3.0	2.7	4.8
5	3.1	2.9	3.6	3.4	3.5	3.3	3.1	2.7	2.9	3.0	2.7	3.2
6	3.1	4.0	3.5	3.5	5.8	3.2	4.2	2.6	2.9	3.0	2.6	2.9
7	3.0	3.9	3.5	3.6	5.6	3.2	4.1	2.8	2.8	2.9	2.6	2.7
8	3.5	5.4	3.5	3.5	5.2	3.2	3.9	2.7	2.8	2.5	2.6	9.9
9	3.1	10.2	3.4	3.5	4.9	3.1	3.1	3.1	2.6	2.5	2.6	7.2
10	3.0	5.2	4.7	3.4	4.2	3.0	3.0	3.9	2.4	2.4	2.6	5.8

Daily gage height, in feet, of Nottely River at Ranger, N. C.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1905.											
11	2.9	4.3	4.1	3.4	4.0	3.0	4.5	3.9	2.4	6.6	2.6
12	11.4	4.2	3.8	3.6	3.8	3.0	9.0	4.0	2.6	3.8	2.6
13	7.2	5.9	3.9	3.7	3.7	3.0	5.0	4.2	2.5	3.2	2.5
14	5.3	4.6	3.8	3.6	3.5	3.0	4.1	3.9	2.5	2.8	2.5
15	5.1	4.2	3.5	3.5	3.5	3.1	3.9	3.4	2.4	2.5	2.5
16	4.5	4.0	3.5	3.9	6.6	3.1	3.3	3.3	2.4	2.5	2.4
17	4.5	3.8	3.5	3.5	4.9	3.2	3.5	3.3	2.4	2.5	2.4
18	3.4	3.6	3.4	3.4	4.2	3.0	3.3	3.2	2.4	2.6	2.3
19	3.3	3.7	3.4	3.4	3.9	3.3	3.2	3.0	2.4	2.6	2.3
20	3.3	4.0	3.5	3.4	3.8	3.4	3.4	3.0	2.3	2.6	2.3
21	3.3	7.8	7.5	3.4	3.6	4.0	3.3	2.9	2.3	2.6	2.3
22	3.2	5.2	4.8	3.5	3.4	3.9	3.2	2.8	2.3	2.6	2.4
23	3.2	5.0	4.4	3.4	5.3	5.0	3.0	2.8	2.3	2.5	2.4
24	3.1	4.7	4.2	3.3	5.0	3.6	3.0	2.8	2.4	2.5	2.4
25	3.0	4.6	3.7	3.3	4.7	3.4	2.9	2.7	2.4	2.5	2.3
26	3.0	4.4	3.6	3.4	4.3	3.4	2.8	2.6	2.4	3.2	2.4
27	3.0	3.9	3.6	4.4	4.0	3.3	2.7	2.6	2.3	2.8	2.5
28	2.9	3.8	3.5	3.8	3.9	3.3	2.8	2.7	2.3	2.7	2.5
29	3.4	.....	3.4	3.8	3.8	3.4	3.0	2.7	2.3	2.7	2.7
30	3.1	.....	3.4	4.6	3.6	3.2	3.0	2.6	2.3	2.6	2.7
31	2.9	.....	3.4	.....	4.0	.....	2.8	2.6	.....	2.6	.....

Rating tables for Nottely River at Ranger, N. C.

FEBRUARY 16, 1901, TO DECEMBER 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	148	4.10	590	5.90	1,130	9.40	2,180
2.40	155	4.20	620	6.00	1,160	9.60	2,240
2.50	172	4.30	650	6.20	1,220	9.80	2,300
2.60	190	4.40	680	6.40	1,280	10.00	2,360
2.70	209	4.50	710	6.60	1,340	11.00	2,660
2.80	229	4.60	740	6.80	1,400	12.00	2,960
2.90	250	4.70	770	7.00	1,460	13.00	3,260
3.00	272	4.80	800	7.20	1,520	14.00	3,560
[b] 3.10	296	4.90	830	7.40	1,580	15.00	3,860
[b] 3.20	322	5.00	860	7.60	1,640	16.00	4,160
3.30	350	5.10	890	7.80	1,700	17.00	4,460
3.40	380	5.20	920	8.00	1,760	18.00	4,760
3.50	410	5.30	950	8.20	1,820	19.00	5,060
3.60	440	5.40	980	8.40	1,880	20.00	5,360
3.70	470	5.50	1,010	8.60	1,940	21.00	5,660
3.80	500	5.60	1,040	8.80	2,000		
3.90	530	5.70	1,070	9.00	2,060		
4.00	560	5.80	1,100	9.20	2,120		

JANUARY 1, 1904, TO DECEMBER 31, 1905.[c]

2.20	101	3.20	320	4.20	624	5.40	1,008
2.30	120	3.30	346	4.30	656	5.60	1,072
2.40	141	3.40	373	4.40	688	5.80	1,136
2.50	162	3.50	402	4.50	720	6.00	1,200
2.60	184	3.60	432	4.60	752	7.00	1,520
2.70	206	3.70	464	4.70	784	8.00	1,840
2.80	228	3.80	496	4.80	816	9.00	2,160
2.90	250	3.90	528	4.90	848	10.00	2,480
3.00	272	4.00	560	5.00	880	11.00	2,800
3.10	295	4.10	592	5.20	944	12.00	3,120

[a] Above gage height 3.3 feet the rating curve is a tangent, the difference being 30 per tenth.
[b] For 1901, 3.10=290 and 3.20=320.
[c] This table is based on 22 discharge measurements made during 1901 to 1905, inclusive. It is defined between gage heights 2.25 feet and 3.50 feet. Above gage height 3.60 feet the rating curve tangent, the difference being 32 per tenth.

Estimated monthly discharge of Nottely River at Ranger, N. C.

[Drainage area, 272 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.					
3-28			514	1.89	0.91
	3,410	440	774	2.85	3.29
	2,000	620	956	3.51	3.92
	3,860	410	894	3.29	3.79
	1,460	530	790	2.90	3.24
	2,300	380	639	2.35	2.71
	4,100	290	1,486	5.46	6.29
	2,660	530	823	3.03	3.38
	590	350	463	1.70	1.96
	560	350	386	1.42	1.58
	5,360	380	927	3.41	3.93
1902.					
	1,250	272	631	2.32	2.67
	5,660	560	1,006	3.70	3.85
	3,500	740	1,095	4.03	4.64
	890	560	711	2.61	2.91
	770	350	475	1.75	2.02
	500	272	322	1.18	1.32
	800	209	307	1.13	1.30
	500	155	219	.81	.93
	380	172	237	.87	.97
	410	148	221	.81	.93
	950	148	295	1.08	1.20
	1,220	272	576	2.12	2.44
ear	5,660	148	508	1.87	25.18
1903.					
	800	272	433	1.59	1.83
	4,610	322	1,095	4.03	4.20
	3,800	770	1,289	4.74	5.46
	1,940	650	1,028	3.78	4.22
	1,070	410	572	2.10	2.42
	1,610	410	810	2.98	3.32
	1,100	272	503	1.85	2.13
	1,460	229	389	1.43	1.65
	560	190	238	.88	.98
	560	172	212	.78	.90
	560	172	232	.85	.95
	500	172	254	.93	1.07
ear	4,610	172	588	2.16	29.13
1904.					
	880	162	293	1.08	1.24
	1,072	250	423	1.56	1.68
	1,936	320	656	2.41	2.78
	1,072	346	472	1.74	1.94
	1,008	250	362	1.33	1.53
	1,616	184	334	1.23	1.37
	624	101	210	.772	.890
	880	184	310	1.14	1.31
	592	101	174	.640	.714
	120	101	103	.379	.437
	272	101	124	.456	.509
	784	141	264	.971	1.12
ear	1,936	101	310	1.14	15.52
1905.					
	2,992	250	501	1.84	2.12
	2,544	250	716	2.63	2.74
	1,680	373	506	1.86	2.14
	752	320	420	1.54	1.72
	1,392	373	640	2.35	2.71
	880	272	364	1.34	1.50
	2,160	206	455	1.67	1.92
	624	184	288	1.06	1.22
	373	120	174	.640	.714
	1,392	120	247	.908	1.05
	206	120	165	.607	.677
	3,056	184	780	2.87	3.31
ear	3,056	120	438	1.61	21.82

TOCCOA RIVER NEAR BLUERIDGE.

This stream, called Toccoa River in Georgia and Oko Tennessee, has its source on the northern slopes of the Mountains in Georgia and flows northwest into Hiwassee area is covered with a fine growth of oak, hickory, and woods. The station, established by B. M. Hall on Novemb is located at the Morganton Bridge, about 4 miles east of Blueridge, Ga. The gage is a 14-foot rod, in two 7-foot sec to a tree on the right bank just below the bridge. It is g feet and tenths and is set to conform to bench marks established October 15, 1896, and October 26, 1898. Th ments during 1896 were made at the railroad bridge ab below, but are referred to the present gage by compar bench marks at the two bridges. The bench mark at the Bridge is on the top of the bridge floor, on the downstre feet from the initial point, and is 18.0 feet above the zero o The bridge was a wooden, queen-post, open bridge, in th with a total length between abutments of 153 feet, but i remodeled and changed into a closed bridge, not suitable making discharge measurements at such an irregular sectio urements are now made at McCays, Tenn., where a gage established.

The observer was W. E. Rogers, a farmer living about a q mile east of the gage. The station was discontinued March

Discharge measurements of Toccoa River near Blueridge.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*	1900.		
April 29	2.95	624	November 28		
November 25	3.15	797	December 17		
1899.			1901.		
March	3.50	1,141	January 23		
April 15	2.40	522	April 5		
September 18	1.93	242	June 26		
October 24	1.90	222	August 23		
1900.			October 31		
March 25	1.85	967	1902.		
May 18	1.62	679	April 25		
July 19	2.00	680	November 21		

Daily gage height, in feet, of Toccoa River near Blueridge.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1898.			1898.			1898.			1898.		
1		3.1	9		3.1	17		2.8	25		
2		3.0	10		3.0	18		2.8	26		
3		3.0	11		2.9	19		2.8	27		
4		3.2	12		2.8	20		3.1	28		
5		3.4	13		2.8	21		3.0	29		
6		3.1	14		2.8	22		2.8	30		
7		3.1	15		2.8	23		3.4	31		
8		3.0	16		2.8	24		3.1			

Daily gage height, in feet, of Toccoa River near Blueridge—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1899.												
1	3.1	3.2	4.3	4.2	3.7	3.0	2.5	2.6	2.8	2.0	2.1	2.4
2	3.0	3.2	4.0	3.6	3.5	2.1	2.45	2.6	2.4	2.0	2.0	2.2
3	2.9	3.3	4.1	3.11	3.5	2.1	2.4	2.5	2.4	1.9	2.0	2.1
4	2.9	5.9	4.1	4.6	3.4	2.2	2.4	2.5	2.5	1.9	2.0	2.1
5	2.1	6.7	4.0	4.4	3.1	3.0	2.5	2.5	2.4	1.9	2.0	2.1
6	3.02	8.9	4.0	3.9	3.6	2.9	2.8	2.5	2.4	2.0	2.0	2.0
7	3.04	6.1	3.8	4.5	3.4	2.9	2.7	2.5	2.3	3.0	2.0	2.0
8	3.08	5.5	3.7	4.8	3.2	2.9	2.8	2.4	2.3	2.8	2.1	2.0
9	3.1	5.0	3.6	4.0	3.2	2.7	2.75	2.3	2.3	2.6	2.1	2.0
10	3.1	4.0	3.1	4.0	3.1	2.7	2.75	2.3	2.5	2.3	2.1	2.5
11	3.2	3.7	3.0	3.1	3.0	2.7	2.7	2.3	2.6	2.1	2.1	3.6
12	3.0	3.8	3.5	3.9	3.0	3.4	2.7	2.6	2.5	2.0	2.1	3.5
13	3.0	3.9	4.0	3.8	3.0	3.2	2.8	3.4	2.3	2.0	2.0	3.3
14	3.1	4.0	4.0	3.7	3.0	3.0	2.7	3.4	2.3	2.0	2.0	2.9
15	3.1	4.0	4.9	3.7	3.0	2.1	2.6	3.4	2.2	2.0	2.1	2.8
16	3.1	4.1	6.0	3.6	3.0	2.7	2.4	3.2	2.2	2.0	2.1	2.5
17	3.2	3.1	4.4	3.6	3.0	2.6	2.4	2.4	2.1	2.0	2.0	2.4
18	3.1	3.3	4.0	3.6	3.0	2.6	2.8	2.4	2.3	2.0	2.0	2.3
19	3.0	3.4	4.5	3.6	3.3	2.6	2.7	2.4	2.3	2.0	2.0	2.6
20	3.0	3.6	5.0	3.6	3.0	2.6	2.7	2.2	2.0	2.0	2.0	2.6
21	2.1	3.5	4.8	3.6	3.2	2.5	2.8	2.2	2.0	2.0	2.0	2.5
22	3.0	3.6	4.6	3.6	3.2	2.45	2.8	2.2	2.0	2.0	2.0	2.4
23	3.8	3.5	5.6	3.8	3.1	2.6	2.6	2.3	2.0	2.0	2.0	2.5
24	3.1	3.4	5.0	4.0	3.1	2.1	2.5	2.2	2.0	2.0	2.0	.....
25	3.2	3.4	4.5	5.3	3.1	2.4	2.8	2.3	2.0	2.0	2.0	.....
26	3.1	4.0	4.2	4.1	3.1	2.7	2.8	2.2	2.0	2.0	2.3	.....
27	2.1	5.8	4.0	4.6	3.1	2.9	3.9	2.4	2.0	2.0	2.6	.....
28	2.1	4.9	4.0	3.1	3.0	2.85	3.6	2.6	2.0	2.0	2.3	.....
29	2.09	.....	4.0	3.0	3.0	2.7	2.8	2.5	2.0	2.2	3.2	.....
30	2.8	.....	4.0	3.3	3.1	2.6	2.8	2.6	2.0	2.4	3.1	.....
31	4.0	.....	4.8	.....	3.11	.....	2.8	2.7	.....	2.2	.....	.....
1900.												
1	.....	.....	.....	3.1	3.6	.....	4.3	3.6	2.6	2.5	3.4	2.6
2	.....	.....	.....	3.1	3.5	.....	4.3	3.5	2.6	2.5	3.4	3.0
3	.....	.....	.....	3.1	3.5	.....	4.2	3.4	2.6	2.5	3.4	3.6
4	.....	.....	.....	3.0	3.4	.....	4.2	3.4	2.6	2.6	3.4	3.6
5	.....	.....	.....	3.0	3.5	.....	4.1	3.4	2.6	2.6	3.4	3.5
6	.....	.....	.....	3.0	3.5	.....	3.6	3.4	2.6	2.6	3.3	3.5
7	.....	.....	.....	3.0	3.4	.....	3.6	3.4	2.6	2.6	3.3	3.4
8	.....	.....	.....	3.0	3.4	.....	3.5	3.4	2.6	2.6	3.3	3.4
9	.....	.....	.....	3.0	3.4	.....	3.5	3.3	2.6	2.6	3.2	3.3
10	.....	.....	.....	3.0	3.3	.....	3.5	3.3	2.6	2.8	3.2	3.3
11	.....	.....	.....	3.4	3.1	.....	3.4	3.3	2.6	2.8	3.1	3.2
12	.....	.....	.....	3.2	3.0	.....	3.4	3.2	2.6	2.9	3.1	3.2
13	.....	.....	.....	3.0	3.0	.....	3.4	3.2	3.0	2.9	3.1	3.0
14	.....	.....	.....	3.0	3.0	.....	3.3	3.2	3.4	2.8	3.1	3.0
15	.....	.....	.....	3.0	3.0	.....	3.3	3.1	4.0	2.8	3.1	2.8
16	.....	.....	.....	3.0	2.8	.....	3.3	2.8	3.6	2.6	3.0	2.8
17	.....	.....	.....	3.3	2.8	.....	3.3	2.8	3.4	2.6	3.0	2.8
18	.....	.....	.....	3.5	2.6	.....	3.2	2.8	3.4	2.6	3.0	2.8
19	.....	.....	.....	3.5	3.6	.....	3.2	2.8	3.2	2.6	3.0	3.8
20	.....	.....	.....	3.4	.....	.....	3.2	2.8	3.2	2.6	3.0	2.7
21	.....	.....	.....	3.3	.....	.....	3.1	2.8	3.0	2.6	3.0	2.7
22	.....	.....	.....	3.3	.....	.....	3.1	3.0	3.0	2.9	2.8	2.6
23	.....	.....	3.4	3.3	.....	.....	3.6	3.0	2.8	8.6	2.7	2.6
24	.....	.....	3.5	3.2	.....	.....	3.5	3.0	2.8	6.0	2.7	2.6
25	.....	.....	3.6	3.5	.....	.....	3.5	2.8	2.6	5.4	2.7	2.6
26	.....	.....	3.5	3.5	.....	.....	3.5	2.8	2.5	4.0	2.7	2.6
27	.....	.....	3.5	3.6	.....	5.0	4.0	2.8	2.5	3.6	2.6	3.0
28	.....	.....	3.4	3.5	.....	5.0	4.0	2.7	2.5	3.6	2.6	3.0
29	.....	.....	3.3	3.4	.....	4.5	3.8	2.7	2.5	3.6	2.6	3.0
30	.....	.....	3.2	3.6	.....	4.3	3.8	2.7	2.5	3.5	2.6	2.8
31	.....	.....	3.2	.....	.....	.....	3.6	2.6	.....	3.4	.....	2.8

Daily gage height, in feet, of Toccoa River near Blueridge—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1901.											
1	3.0	3.0	3.0	4.0	3.6	4.0	3.0	3.5	4.0	3.2	
2	3.0	3.0	3.0	4.0	3.6	4.0	3.0	3.2	4.0	3.0	
3	3.0	4.0	3.0	4.0	3.5	4.0	3.0	3.0	4.0	3.0	
4	3.0	4.0	3.0	4.0	3.5	4.0	3.0	3.0	4.0	3.0	
5	3.0	3.5	3.0	4.0	3.5	3.8	3.0	6.0	4.0	3.0	
6	3.0	3.5	3.0	4.0	3.5	3.8	3.0	4.0	4.0	3.0	
7	2.8	3.4	3.0	3.8	3.5	3.6	3.0	4.0	4.0	3.0	
8	2.8	3.4	3.0	3.8	3.5	3.6	3.0	4.0	4.0	3.0	
9	3.0	3.0	3.5	3.8	3.4	3.5	3.0	3.5	4.0	3.0	
10	4.0	3.0	3.4	3.8	3.4	3.5	3.0	3.5	3.6	3.0	
11	7.4	3.0	3.3	3.7	3.4	3.5	3.0	3.5	3.6	3.0	
12	5.0	3.0	3.0	3.7	3.2	3.5	3.0	4.0	6.6	3.0	
13	4.0	3.0	3.0	3.7	3.2	3.5	3.0	4.0	3.6	3.0	
14	3.8	3.0	3.0	3.6	3.0	3.5	3.0	4.0	3.5	3.0	
15	3.8	3.0	3.0	3.6	3.0	3.5	3.0	5.0	3.5	3.0	
16	3.6	3.0	3.0	3.6	3.0	3.4	3.0	5.0	3.5	3.0	
17	3.6	3.0	3.0	3.5	3.0	3.4	3.0	5.0	3.4	3.0	
18	3.4	3.0	3.0	3.5	3.0	3.4	4.0	4.5	3.4		
19	3.4	3.0	3.0	5.5	3.0	3.2	4.0	4.5	3.0		
20	3.2	2.8	3.0	4.5	11.0	3.2	3.5	4.5	3.0		
21	3.0	2.8	3.0	4.0	6.0	3.2	3.0	4.0	3.0		
22	3.0	2.8	3.0	4.0	6.0	3.2	3.0	14.0	3.0		
23	3.0	2.8	3.0	4.0	5.0	3.0	3.0	8.0	3.0		
24	3.0	3.0	3.0	4.0	5.0	3.0	3.0	6.0	3.0		
25	4.0	3.0	7.0	3.8	5.0	3.0	3.0	5.0	3.0		
26	3.5	3.0	6.0	3.8	4.0	3.0	3.0	4.0	3.0		
27	3.5	3.0	4.0	3.8	3.6	3.0	3.0	4.0	3.0		
28	3.2	3.0	4.0	3.6	3.6	3.0	3.0	4.0	4.0		
29	3.2	.....	4.0	3.6	3.6	3.0	3.0	4.0	4.0		
30	3.2	.....	4.0	3.6	3.6	3.0	3.0	4.0	3.5		
31	3.0	.....	4.0	.....	4.0	.....	4.0	4.0	.....		
1902.											
1	5.0	4.0	4.0	4.8	3.5	2.8	2.5	2.6	2.8	2.5	
2	5.0	4.0	4.0	4.8	3.5	2.8	2.5	2.6	3.0	2.5	
3	5.0	4.0	4.0	4.6	3.4	2.8	2.5	2.4	3.0	2.5	
4	4.6	4.0	4.0	4.6	3.0	2.8	2.5	2.4	3.0	2.5	
5	4.5	4.0	3.8	4.5	3.0	2.8	2.5	2.4	3.0	2.5	
6	4.3	4.0	3.8	4.0	3.0	2.8	2.5	2.3	2.8	2.5	
7	4.0	4.0	3.7	4.0	3.0	2.8	2.5	2.3	2.8	2.5	
8	4.0	4.0	3.7	4.0	3.0	3.0	2.4	2.3	2.8	2.5	
9	4.0	4.0	4.0	4.0	3.0	3.0	2.4	2.3	2.6	2.5	
10	4.0	4.0	6.0	4.8	3.0	3.0	2.4	2.3	2.6	2.5	
11	4.0	4.0	5.5	4.8	3.0	3.0	2.3	2.5	2.6	2.5	
12	3.6	4.3	5.5	4.0	3.0	3.0	2.6	2.3	3.0	2.5	
13	3.6	4.2	5.0	4.0	3.0	3.0	2.4	2.3	3.0	2.5	
14	3.6	4.0	5.0	3.8	3.0	3.0	2.4	2.3	2.8	2.5	
15	3.5	4.0	5.0	3.8	3.0	2.8	2.4	2.3	2.8	2.5	
16	3.5	4.0	5.0	3.8	3.0	2.8	2.4	2.3	2.8	2.5	
17	3.5	4.0	4.8	3.6	3.0	2.8	2.4	2.2	2.8	2.5	
18	3.5	4.0	4.8	3.6	3.0	2.8	2.4	2.2	2.8	2.5	
19	3.5	6.0	4.6	3.6	3.0	2.7	2.4	2.2	2.8	2.5	
20	3.5	10.0	4.6	3.4	3.0	2.7	2.4	2.2	2.8	2.5	
21	3.4	5.0	4.3	3.4	3.0	2.7	2.4	2.2	2.8	2.5	
22	3.4	5.0	4.0	3.4	3.0	2.6	2.4	2.2	2.7	2.5	
23	3.4	5.0	4.0	3.4	3.0	2.6	2.4	2.2	2.7	2.5	
24	3.4	4.0	4.0	3.2	3.0	2.5	2.4	2.2	2.6	2.5	
25	3.4	4.0	4.0	3.2	3.0	2.5	2.4	2.2	2.6	2.5	4.0
26	4.0	4.0	4.0	3.2	3.0	2.5	2.4	2.2	2.6	2.4	3.9
27	4.0	4.0	4.0	3.4	3.0	2.5	2.4	3.0	2.6	2.4	3.9
28	3.9	4.0	3.8	3.4	3.0	2.5	2.4	3.0	2.5	2.4	3.6
29	5.0	.....	6.0	3.4	2.8	2.5	2.4	3.0	2.5	2.4	3.6
30	4.5	....	5.0	3.5	2.8	2.5	2.4	2.8	2.5	2.4	3.6
31	4.5	.....	5.0	.....	2.8	.....	2.6	2.8	.....	2.4	.....

Daily gage height, in feet, of Toccoa River near Blueridge—Continued.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1903.				1903.				1903.			
.....	3.0	3.0	6.0	12.....	2.8	3.8	4.0	22.....	3.0	3.8	4.0
.....	3.0	3.0	5.0	13.....	2.8	3.6	4.0	23.....	3.0	3.8	4.0
.....	3.5	4.0	5.0	14.....	2.8	3.6	4.0	24.....	3.0	3.8	4.0
.....	3.0	5.0	5.0	15.....	2.8	4.0	4.0	25.....	3.0	3.8	4.0
.....	3.0	4.0	4.8	16.....	2.8	4.0	4.0	26.....	3.0	3.6	4.0
.....	2.8	4.0	4.8	17.....	2.8	4.0	4.0	27.....	3.0	3.6	3.8
.....	2.8	4.0	4.6	18.....	2.8	4.0	4.0	28.....	3.0	10.0	3.8
.....	2.8	3.0	4.5	19.....	2.8	3.8	4.0	29.....	3.0	.....	4.0
.....	2.8	4.0	4.5	20.....	3.0	3.8	4.0	30.....	3.0	.....	7.0
.....	2.8	4.0	4.2	21.....	3.0	3.8	4.0	31.....	3.0	.....	6.0
.....	2.8	3.8	4.2								

Rating tables for Toccoa River near Blueridge.

NOVEMBER 25, 1898, TO DECEMBER 31, 1899.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	230	3.40	1,064	4.90	2,204	6.80	3,648
2.00	255	3.50	1,140	5.00	2,280	7.00	3,800
2.10	280	3.60	1,216	5.10	2,356	7.20	3,952
2.20	305	3.70	1,292	5.20	2,432	7.40	4,104
2.30	335	3.80	1,368	5.30	2,508	7.60	4,256
2.40	370	3.90	1,444	5.40	2,584	7.80	4,408
2.50	420	4.00	1,520	5.50	2,660	8.00	4,560
2.60	475	4.10	1,596	5.60	2,736	8.20	4,712
2.70	540	4.20	1,672	5.70	2,812	8.40	4,854
2.80	610	4.20	1,748	5.80	2,888	8.60	5,016
2.90	685	4.40	1,824	5.90	2,964	8.80	5,168
3.00	760	4.50	1,900	6.00	3,040	9.00	5,320
3.10	836	4.60	1,976	6.20	3,192		
3.20	912	4.70	2,052	6.40	3,344		
3.30	988	4.80	2,128	6.60	3,496		

JANUARY 1 TO DECEMBER 31, 1900.[b]

2.50	423	3.80	1,435	5.10	2,735	6.80	4,435
2.60	460	3.90	1,535	5.20	2,835	7.00	4,635
2.70	502	4.00	1,635	5.30	2,935	7.20	4,835
2.80	550	4.10	1,735	5.40	3,035	7.40	5,035
2.90	605	4.20	1,835	5.50	3,135	7.60	5,235
3.00	675	4.30	1,935	5.60	3,235	7.80	5,435
3.10	750	4.40	2,035	5.70	3,335	8.00	5,635
3.20	837	4.50	2,135	5.80	3,435	8.20	5,835
3.30	935	4.60	2,235	5.90	3,535	8.40	6,035
3.40	1,035	4.70	2,335	6.00	3,635	8.60	6,235
3.50	1,135	4.80	2,435	6.20	3,835		
3.60	1,235	4.90	2,535	6.40	4,035		
3.70	1,335	5.00	2,635	6.60	4,235		

JANUARY 1, 1901, TO MARCH 31, 1903.[c]

2.20	270	3.50	1,062	4.80	2,446	7.20	5,014
2.30	312	3.60	1,162	4.90	2,553	7.40	5,228
2.40	355	3.70	1,269	5.00	2,660	7.60	5,442
2.50	400	3.80	1,376	5.20	2,874	7.80	5,656
[d] 2.60	447	3.90	1,483	5.40	3,088	8.00	5,870
[d] 2.70	497	4.00	1,590	5.60	3,302	9.00	6,940
[d] 2.80	550	4.10	1,697	5.80	3,516	10.00	8,010
2.90	606	4.20	1,804	6.00	3,730	11.00	9,080
3.00	666	4.30	1,911	6.20	3,944	12.00	10,150
3.10	732	4.40	2,018	6.40	4,158	13.00	11,220
3.20	804	4.50	2,125	6.60	4,372	14.00	12,290
3.30	883	4.60	2,232	6.80	4,586		
3.40	969	4.70	2,339	7.00	4,800		

[a] Above gage height 3.00 feet the rating curve is a tangent, the difference being 76 per tenth.
[b] Above gage height 3.30 feet the rating curve is a tangent, the difference being 100 per tenth.
[c] Above gage height 3.60 feet the rating curve is a tangent, the difference being 107 per tenth.
[d] For 1901, 2.60 = 460, 2.70 = 503, 2.80 = 552.

Estimated monthly discharge of Toccoa River near Blueridge.

[Drainage area, 231 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec-ft. per sq. mile.	Depth in inches
1898.					
November 25–30	1,064	836	988	4.28	0.9
December	1,064	610	745	3.23	3.7
1899.					
January	1,520	280	733	3.17	3.6
February	5,244	836	1,759	7.61	7.9
March	3,040	760	1,704	7.38	8.5
April	2,508	760	1,411	6.11	6.8
May	1,292	760	884	3.83	4.4
June	1,064	280	545	2.36	2.6
July	1,444	370	575	2.49	2.8
August	1,064	305	471	2.04	2.3
September	610	255	329	1.42	1.5
October	760	230	298	1.29	1.4
November	912	255	315	1.36	1.5
December 1–23	1,216	255	473	2.05	1.7
1900.					
March 23–31	1,235	837	1,035	4.48	1.9
April	1,235	675	878	3.80	4.2
May 1–19	1,235	460	900	3.90	2.9
June 27–30	2,635	1,935	2,335	10.11	1.8
July	1,935	750	1,226	5.31	6.1
August	1,235	460	761	3.29	3.7
September	1,635	423	629	2.72	3.0
October	6,235	423	1,007	4.36	5.0
November	1,035	460	728	3.15	3.5
December	1,235	460	710	3.07	3.5
1901.					
January	5,228	552	1,100	4.76	5.4
February	1,590	552	765	3.31	3.4
March	4,800	666	1,077	4.66	5.3
April	3,195	1,062	1,458	6.31	7.0
May	9,080	666	1,599	6.92	7.9
June	1,590	666	1,011	4.38	4.8
July	1,590	666	768	3.32	3.8
August	12,290	666	2,248	9.73	11.2
September	1,590	666	1,144	4.95	5.5
October	804	552	619	2.68	3.0
November	552	460	493	2.13	2.3
December	10,150	552	2,248	9.73	11.2
The year	12,290	460	1,211	5.24	71.0
1902.					
January	2,660	969	1,602	6.94	8.0
February	8,010	1,590	2,029	8.78	9.1
March	3,730	1,269	2,104	9.11	10.5
April	2,446	804	1,459	6.32	7.0
May	1,062	550	690	2.99	3.4
June	666	400	530	2.29	2.5
July	447	312	370	1.60	1.8
August	666	270	361	1.56	1.8
September	666	400	531	2.30	2.5
October	447	355	406	1.76	2.0
November	1,590	312	476	2.06	2.3
December	1,590	666	866	3.75	4.3
The year	8,010	270	952	4.12	55.9
1903.					
January	1,062	550	626	2.71	3.1
February	8,010	666	1,629	7.05	7.3
March	4,800	1,376	2,046	8.86	10.2

OKOEE RIVER AT M'CAYS, TENN.

This station was established March 21, 1903, by O. P. Hall. It is located at a suspension footbridge just below McCays Ferry, at McCays, Tenn., near the Georgia-Tennessee boundary, and one-half mile below the railroad bridge of the Atlanta, Knoxville and Northern Railroad.

The channel is practically straight for about 800 feet above and below the station. The right bank will overflow at about 14 feet gage height for about 500 feet, and the left bank at gage height 12 to 20 feet for about 400 feet. The water is confined to one channel and the bed is probably constant. The current is fairly swift and the section is good for measurement. Discharge measurements are made from the suspension footbridge.

The gage is in two sections, the inclined section reading from −0.3 to 8.5 feet, set in a trench and held in place by posts driven into the ground. The vertical section, reading from 8 to 18 feet, is attached to the bridge posts on the right bank. The gage is read twice each day by Arch Ballew. Bench marks were established as follows: (1) The head of a large nail in the center of a post at the right-bank end of the footbridge on the downstream side; elevation, 16.10 feet; this post is an anchor post for the cable of the suspension bridge and may be pulled out of place. (2) A copper plug set in solid rock at the outer edge of the side ditch of the railroad bed, about 800 feet west of the railroad station at McCays, 11 feet north of the center of the track, and slightly higher than the railroad; elevation, 20.98 feet. Elevations refer to the datum of the gage.

Discharge measurements of Okoee River at McCays, Tenn.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1903.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
March 21	3.42	2,063	February 25	1.40	701
May 12	1.87	992	February 26	1.30	669
May 14	1.86	990	May 11	1.33	629
July 24	1.37	727	June 30	.82	386
August 21	1.17	584	August 26	.65	354
October 8	1.22	624	October 10	.30	214
October 9	.85	429			
December 7	.53	307	1905.		
			April 10	1.22	666
1904.			June 19	1.18	608
February 22	2.80	1,664	October 5	.77	413

Daily gage height, in feet, of Okoee River at McCays, Tenn.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	D.
1903.												
1				3.7	2.3	2.7	1.6	1.4	0.8	0.6	0.7	0.6
2				3.5	2.3	3.9	1.6	1.3	.8	.6	.7	.6
3				3.3	2.2	2.8	1.6	1.6	.9	.6	.9	.7
4				3.6	2.2	2.7	1.7	1.2	.9	.6	.9	.7
5				3.1	2.1	4.3	1.5	1.4	.9	.6	1.2	.6
6				3.1	2.1	4.1	1.5	1.3	.8	.6	.9	.6
7				3.0	2.1	3.1	1.6	1.2	.8	.6	.8	.5
8				4.4	2.0	2.6	1.6	1.1	.8	1.5	.7	.5
9				3.2	2.0	2.4	1.5	1.1	.9	.9	.7	.5
10				3.1	2.0	2.3	1.6	1.1	.9	.7	.6	.6
11				2.9	2.0	2.8	2.3	1.6	.8	.7	.6	.7
12				2.8	1.9	2.3	1.8	1.1	.8	.7	.9	.7
13				3.3	1.9	2.2	6.3	1.1	.7	.6	.7	.7
14				3.1	1.9	2.1	2.6	1.0	.7	.6	.7	.6
15				3.5	1.9	2.0	1.9	1.8	1.0	.6	.7	.6
16				3.2	1.8	2.0	1.7	1.9	1.3	.6	.7	.5
17				3.1	1.7	1.8	1.8	1.3	1.0	.9	1.2	.5
18				3.1	1.7	1.8	1.6	1.9	.9	.9	1.2	.5
19				2.9	1.7	1.7	1.5	1.2	.8	.7	.8	.4
20				3.1	1.7	1.7	1.5	2.4	.8	.7	.8	.9
21				2.9	1.7	1.7	1.4	1.2	.8	.6	.7	.8
22			4.3	2.7	1.6	1.7	1.4	1.1	.8	.6	.7	.8
23			5.0	2.6	1.6	1.7	1.4	1.1	.7	.6	.7	.6
24			4.6	2.5	1.6	1.6	1.4	1.0	.7	.6	.7	.6
25			3.7	2.5	1.5	1.6	1.3	1.0	.7	.6	.6	.5
26			3.5	2.6	1.5	1.8	1.3	1.0	.7	.6	.6	.7
27			3.3	2.5	1.5	2.2	1.3	.9	.7	.6	.6	.7
28			3.2	2.4	1.5	2.6	1.3	.9	.7	.6	.6	.6
29			3.4	2.3	1.5	1.8	1.2	.9	.7	.6	.6	.7
30			6.4	2.3	1.8	1.6	1.4	.9	.6	.6	.6	.7
31			4.3	.....	1.9	.....	1.7	.9	.....	.7	.....	.9
1904.												
1	0.6	0.9	1.1	1.5	1.2	1.45	.75	1.6	.6	.3	.3	.6
2	.6	.8	1.2	1.5	1.25	1.2	.7	.95	.55	.3	.3	.55
3	.7	.9	1.2	1.4	1.25	1.0	.7	.75	.55	.35	.4	1.0
4	.6	.9	1.2	1.35	1.3	1.0	.65	.75	.55	.35	.5	.9
5	.6	.8	1.0	1.3	1.2	.9	.9	1.0	.7	.3	.5	1.8
6	.6	.8	1.0	1.35	1.1	.9	.8	.95	.6	.3	.4	1.4
7	.7	.8	3.0	1.9	1.1	2.1	.7	1.1	.5	.3	.35	.7
8	.6	1.8	2.0	2.3	1.95	1.2	.75	1.7	.5	.3	.3	.9
9	.6	.9	1.6	2.1	1.8	.9	.9	1.25	.5	.3	.3	.5
10	.6	1.0	1.5	1.7	1.45	.9	.75	1.05	.5	.3	.3	.6
11	.8	1.2	1.6	1.65	1.3	.85	.7	1.45	.45	.3	.3	.5
12	.7	1.0	1.45	1.55	1.25	.9	1.2	1.1	.45	.3	.35	.5
13	.7	.9	1.3	1.5	1.2	.85	1.0	1.2	.45	.3	.55	.5
14	.7	.9	2.35	1.4	1.2	.8	.75	.95	.45	.3	.55	.4
15	.7	1.0	1.35	1.4	1.2	.8	.65	1.0	.4	.25	.5	.6
16	.7	.9	1.4	1.4	1.15	.75	.75	.85	.4	.25	.45	.4
17	1.3	.9	1.3	1.35	1.1	.75	.8	.75	.4	.25	.35	.35
18	1.0	.8	1.3	1.35	1.1	.7	.6	.7	.4	.25	.3	.5
19	.8	.9	1.3	1.3	1.1	.7	.6	.75	.4	.25	.3	.45
20	.7	2.0	1.3	1.25	1.15	.8	.55	.8	.35	.25	.3	.4
21	.7	2.0	2.25	1.3	1.0	.75	.6	.7	.4	.25	.35	.4
22	1.0	2.9	2.25	1.35	1.0	1.2	1.1	.6	.45	.25	.4	.4
23	1.7	2.2	3.6	1.25	1.0	.8	.75	.6	.4	.25	.65	.4
24	1.4	1.7	2.8	1.2	.9	.7	.7	.75	.35	.25	.4	.45
25	1.2	1.4	2.2	1.2	1.0	.65	.9	.7	.35	.25	.4	.75
26	1.1	1.3	1.95	1.35	.95	.7	.85	.7	.35	.3	.3	.6
27	.9	1.3	2.2	1.5	.9	.7	.65	.95	.35	.3	.3	.55
28	1.0	1.2	1.85	1.35	.9	.7	1.0	.75	.4	.3	.3	1.25
29	.9	1.1	1.7	1.3	.9	1.2	.75	.65	.35	.3	.3	1.05
30	.9	.....	1.6	1.2	.9	.85	.7	.6	.3	.3	.75	.8
31	.8	.....	1.55	.....	2.35	.....	.75	.6	.....	.3	.....	.7

Daily gage height, in feet, of Okoee River at McCays, Tenn.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
	0.7	0.77	1.5	1.3	1.45	1.4	1.7	0.9	0.8	0.92	0.68	0.6
	.7	.8	1.4	1.2	1.35	1.3	1.25	.82	1.7	.7	.6	.6
	.7	.8	1.4	1.2	1.3	1.3	1.1	.8	1.1	.88	.6	4.6
	.7	.75	1.4	1.2	1.5	1.25	1.0	.8	.92	1.2	.65	1.6
	.63	1.0	1.3	1.4	1.4	1.2	1.0	.8	.8	.78	.62	1.4
	.8	1.55	1.3	1.45	1.65	1.2	1.0	.75	.8	.68	.63	1.2
	.5	1.25	1.4	1.4	1.7	1.2	1.0	.9	.8	.6	.62	1.2
	.9	1.45	1.3	1.3	1.7	1.15	1.15	1.25	.8	.6	.6	3.6
	.8	3.1	1.7	1.2	1.8	1.1	1.0	1.0	.8	.6	.6	3.4
	.9	2.45	2.0	1.2	1.55	1.0	1.2	1.15	.72	.8	.6	2.4
	.95	1.85	1.25	1.2	1.4	1.0	1.5	2.15	.75	3.3	.6	1.9
	6.4	1.65	1.5	1.7	1.35	1.15	4.4	1.75	1.15	1.35	.6	1.65
	3.5	1.7	1.55	1.35	1.3	1.1	2.0	1.65	.8	.95	.6	1.5
	2.0	1.85	1.5	1.2	1.2	1.0	1.5	1.8	.73	.8	.6	1.55
	1.1	1.75	1.4	1.35	1.55	1.5	1.3	1.95	.72	.82	.6	1.7
	1.1	1.5	1.3	1.4	2.8	1.5	1.45	1.45	.72	.9	.6	1.6
	1.1	1.5	1.3	1.2	1.8	1.65	1.3	1.4	.7	.8	.6	1.45
	1.0	1.4	1.3	1.2	1.6	1.3	1.15	1.2	.7	.72	.6	1.4
	1.0	1.3	1.25	1.2	1.5	1.3	1.4	1.1	.65	.68	.55	1.35
	1.0	4.2	1.7	1.15	1.5	1.1	1.2	1.0	.7	.6	.8	1.7
	.98	4.1	3.0	1.15	1.45	1.4	1.1	1.0	.7	.65	.75	2.7
	.93	3.3	1.95	1.25	1.4	1.25	1.1	1.0	.62	.62	.6	2.0
	.9	2.25	1.7	1.1	3.0	1.85	1.0	1.1	.6	.65	.6	2.2
	.83	2.15	1.7	1.1	2.2	1.25	1.0	1.1	.6	.6	.72	2.0
	.8	2.0	1.6	1.1	1.85	1.2	1.05	1.15	.6	.7	.7	1.75
	.8	1.85	1.5	1.25	1.8	1.15	.95	1.4	.6	1.2	.62	1.6
	.75	1.65	1.4	1.7	1.7	1.3	.9	1.0	.55	.85	.62	1.55
	1.1	1.55	1.4	1.45	1.6	1.5	.9	.95	.55	.75	.6	1.5
	1.1	.....	1.35	1.5	1.5	1.8	2.15	.85	.55	.7	.65	1.7
	.9	.....	1.45	1.85	1.45	1.65	1.0	.8	.58	.7	.75	1.5
	.85	.....	1.3	.....	1.5	.....	1.0	.8	.....	.7	.....	1.45

'ating table for Okoee River at McCays, Tenn., from March 20, 1903, to December 31, 1905. [a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	200	1.30	655	2.30	1,275	3.60	2,200
.30	230	1.40	710	2.40	1,340	3.80	2,350
.40	262	1.50	767	2.50	1,410	4.00	2,500
.50	296	1.60	826	2.60	1,480	4.20	2,650
.60	332	1.70	887	2.70	1,550	4.40	2,800
.70	370	1.80	950	2.80	1,620	4.60	2,950
.80	411	1.90	1,015	2.90	1,690	4.80	3,100
.90	455	2.00	1,080	3.00	1,760	5.00	3,250
1.00	502	2.10	1,145	3.20	1,900	5.50	3,650
1.10	551	2.20	1,210	3.40	2,050	6.00	4,050
1.20	602						

[a] This table is based on 18 discharge measurements made during 1903–1905. It is well defined between heights 0.25 foot and 3.4 feet.

Estimated monthly discharge of Okoee River at McCays, Tenn.

[Drainage area, 374 square miles.]

Month.	Discharge in second-feet.			Run-off
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.
1903.				
March 22-31	4,370	1,900	2,634	7.05
April	2,800	1,275	1,772	4.74
May	1,275	767	982	2.63
June	2,725	826	1,306	3.49
July	4,290	602	936	2.50
August	1,340	455	642	1.72
September	655	332	419	1.12
October	767	332	365	.976
November	602	332	398	1.06
December	455	297	340	.909
1904.				
January	887	332	435	1.16
February	1,660	411	630	1.68
March	2,200	502	922	2.47
April	1,275	602	745	1.99
May	1,308	455	610	1.63
June	1,145	351	475	1.27
July	602	314	403	1.08
August	887	332	470	1.26
September	370	230	279	.746
October	246	215	226	.604
November	390	230	261	.698
December	1,242	262	407	1.09
The year	2,200	215	488	1.31
1905.				
January	4,370	296	649	1.74
February	2,650	390	1,012	2.71
March	1,760	628	786	2.10
April	982	551	663	1.77
May	1,760	602	850	2.30
June	982	502	661	1.77
July	2,800	455	687	1.84
August	1,178	390	592	1.58
September	887	314	401	1.07
October	1,975	332	459	1.23
November	411	314	344	.920
December	2,950	332	991	2.65
The year	4,370	296	675	1.81

FIGHTINGTOWN CREEK AT M'CAYS, TENN.

This station was established August 27, 1904, for the purp making miscellaneous measurements. It is located about or mile above the mouth of the creek, which flows into Okoee about one-half mile below the gaging station at McCays, Tenn. ingtown Creek is in Georgia, but its mouth is in Tennessee.

Both banks are open cultivated lands, which will probably flow. The bed is sandy, and will probably change much. Disc measurements are made by means of a boat or by wading. bench mark is two small nails driven into the largest of a clus small maple sprouts on the right bank, 40 feet above the mout small branch; elevation, 5.00 feet above datum of assumed gage

Discharge measurements of Fightingtown Creek at McCays, Tenn.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1904.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec.-ft.*
May 12	[a] 1.25	122	June 20	2.00	123
August 27	1.72	79	October 6	1.61	59
October 11	1.12	40			

[a] Gage height given is for the Okoee River at McCays.

MISCELLANEOUS MEASUREMENTS, HIWASSEE RIVER DRAINAGE BASIN IN GEORGIA.

Fightingtown Creek.—This stream is a tributary of Toccoa River. A measurement was made October 4, 1904, at the Galloway bridge, near Blueridge, above the Horseshoe Bend.

Width, 33 feet; area, 25 square feet; mean velocity, 1 foot per second; discharge, 25 second-feet.

Toccoa River.—This stream is a tributary of Hiwassee River, its name becoming Okoee River in the State of Tennessee. A measurement was made October 3, 1904, from a small boat at Bench Leg Ford, near Blueridge, 1 mile below the Morganton road bridge, and one-fourth mile below the mouth of Weaver Creek.

Width, 110 feet; area, 264 square feet; mean velocity, 0.65 foot per second; discharge, 172 second-feet.

RIVER SURVEYS IN HIWASSEE RIVER DRAINAGE BASIN.

HIWASSEE RIVER.

The elevations in the following list are based on an aluminum tablet marked "1984 ATLANTA" at the northeast corner of front vestibule of Towns County court-house, Hiwassee, the elevation of which is accepted as 1,983.634 feet above sea level.

The leveling is adjusted with flying levels on Nottely River to accord with the 1903 adjusted elevation of the primary bench marks at Blairsville and Hiwassee. From the mouth of the Nottely to Apalachia the leveling is a single spur line.

The leveling was done in 1903 by Thomas B. O'Hagan, levelman, under the direction of Carroll Caldwell, field assistant, United States Geological Survey.

Elevations on Hiwassee River from Hiwassee, Ga., to Apalachia, N. C.

Miles above mouth.	Description of points.	Elevation above sea level.
		Feet.
	Hiwassee, Towns County court-house, at northeast corner of front vestibule, aluminum bolt marked "ATLANTA 1894"	1,985.64
0.5	Hiwassee Bridge, 30 feet north of north edge of county road, white-oak tree, nail in west side	1,962.4
0.5	Hiwassee Bridge, 30 feet north of, water surface	1,865
0.5	High-water mark	1,882
0.5	Bridge, water surface	1,861
0.8	Town Branch, mouth, water surface	1,862
1.0	25 feet south of bridge, 20 feet west of river, point on rock bluff	1,871.36
1.0	Bridge, water surface	1,857
1.0	Bridge floor	1,874.8
1.0	High-water mark	1,870
1.7	Hog Creek, water surface	1,855
1.9	Small rapids, water surface	1,854
2.2	Bear Creek, 400 feet north, on east side of river, triple maple tree, nail in side of	1,854.14
2.2	Bear Creek, mouth of, water surface	1,853
2.3	Small rapids, water surface	1,851
2.3	Small rapids, foot, water surface	1,847
2.8	Water surface	1,850
3.4	Long Ford, mouth, water surface	1,856
3.6	Hog Creek, mouth, water surface	1,853
3.7	Water surface	1,850
3.8	Coleson Creek, mouth, water surface	1,829
4.8	Long Branch Creek, mouth, water surface	1,825
4.8	Ford, foot, Ford, 25 feet northwest, nail in side of dead stump	1,826.2
4.8	Ford, top, Ford, water surface	1,823
4.8	High-water mark	1,835
5.2	Spooking Creek, mouth, water surface	1,820
5.5	Water surface	1,819
5.6	Ford, 75 feet northwest, 30 feet west of road, nail in red-oak tree	1,820.62
6.1	15 feet north of river, point on rock	1,824.68
6.2	Water surface	1,811
6.4	Stream, mouth, water surface	1,809
6.4	Rough ford, 15 feet north of river, rock bluff, point on rock	1,816.84
6.9	Water surface	1,807
7.2	Shooting Creek, mouth, water surface	1,804
7.9	Barnard Bridge, northeast abutment, point on top	1,818.31
7.9	Barnard Bridge, water surface	1,797
7.9	Barnard Bridge, bridge floor	1,819.7
7.9	Barnard Bridge, high-water mark	1,814
8.3	Ford, water surface	1,794
8.3	Ford, 5 feet south of ford, 15 feet north of river, nail in side of dogwood tree	1,807.86
8.8	Water surface	1,790
9.0	Head of island, water surface	1,788
9.2	Hightts Mill Creek, mouth, water surface	1,787
9.4	Herbert Ford, on south edge of river at, nail in side of birch tree	1,791.19
9.4	High water mark	1,798
9.4	Water surface	1,787
.....	Bear Creek, mouth, water surface	1,787
10.0	12 feet west of river, point on rock	1,796.74
10.0	Water surface	1,782
10.8	Town Creek, mouth, water surface	1,778
11.5	Tusquitte Bridge, 250 feet west, on edge of river, nail in root of birch tree	1,778.9
11.5	Tusquitte Bridge, water surface	1,774
11.7	High-water mark	1,794
11.8	Martin or Quail Creek, mouth, water surface	1,774
12.2	Water surface	1,773
12.6	Tusquitte Creek, mouth, 150 feet northwest, 10 feet west of river nail in root of birch tree	1,777.06
12.6	Water surface	1,771
12.8	Rapids, water surface	1,767
13.3	Below rapids, water surface	1,760
13.6	Stream, mouth, water surface	1,759
14.0	Martin Ford, 125 feet south, on west edge of river, at fish trap, nail in root of birch	1,757.74
14.0	Martin Ford, water surface	1,756
14.8	Water surface	1,742
14.9	Leatherwood Ford, 25 feet northwest, nail in walnut tree	1,749.19
14.9	Leatherwood Ford, water surface	1,741
16.0	Adkon Creek, mouth, water surface	1,741
16.4	Water surface	1,722
17.0	Fire Creek, mouth, water surface	1,712
17.3	Stream, mouth, water surface	1,709
17.5	Passmore Ford, east side of river, in center of ford road, nail in root of gum tree	1,708.84
17.5	Passmore Ford, water surface	1,707
17.7	Cloud Fire Creek, mouth, water surface	1,710
18.3	Water surface	1,690
18.8	Betty Creek, mouth, water surface	1,685
19.1	Head of island, water surface	1,679
19.4	Sweetwater Creek, mouth, water surface	1,673
19.6	Stream, mouth, water surface	1,618
20.0	Shallow Ford, 15 feet east of river, nail in side of birch tree	1,667.14

Elevations on Hiwassee River from Hiwassee, Ga., to Apalachia, N. C.—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
20.0	Water surface	1,663
20.5	Water surface	1,659
20.9	End of island	1,649
21.0	Creek, mouth	1,642
21.4	Water surface	1,632
21.5	Water surface	1,629
21.8	Backwater of Cherokee dam, 1,560 feet from, at small rapids, water surface	1,624
22.0	Top of Cherokee dam, water surface	1,625
22.0	Foot of Cherokee dam, water surface	1,614
22.0	Cherokee dam, 25 feet southwest, point on rock	1,616.59
22.0	Water surface	1,609
22.2	Canewater Ford, water surface	1,606
24.0	Rocky Branch, mouth, water surface	1,591.4
24.0	North edge of river, nail in side of birch tree	1,594.79
24.1	Small rapids, foot, water surface	1,590
24.7	Stream, mouth, water surface	1,586
25.2	Brasstown Creek, mouth, water surface	1,576
26.2	Island Ford, 700 feet east, south side of river, point on rock	1,666.56
27.6	Peachtree Creek, mouth, water surface	1,550
28.0	Horseshoe Ford, water surface	1,549
28.0	South side of ford, nail in side of beech tree	1,553.06
29.5	20 feet north of river, north side of road, point on rock	1,548.7
29.9	Scott Branch, mouth, water surface	1,539
30.4	Stream, mouth, water surface	1,529
31.3	Martins Creek, mouth, water surface	1,520
31.6	Twin beech tree, nail in root	1,518.12
31.8	Stream, mouth, water surface	1,513
32.1	Murphy, N. C., iron bridge, south abutment, point on rock	1,518.3
32.1	Murphy, N. C., iron bridge, water surface	1,512
32.1	Bridge floor	1,531.9
32.1	High-water mark	1,529
32.5	Valley River, mouth, west shore, 20 feet north of, in water, point on rock	1,506.85
32.5	Water surface	1,506
34.0	Water surface	1,491
34.9	Laurel Creek, mouth, water surface	1,474
35.3	Johnson Ford, 8 feet south of river, nail in root of large birch tree	1,471.95
35.3	Johnson Ford, water surface	1,469
35.3	High-water mark	1,481
35.9	Hangingdog Creek, mouth, water surface	1,462
36.5	Water surface	1,459
37.0	Nottely River, mouth, water surface	1,455
37.0	Island projecting between the two rivers, nail in root of birch tree	1,459.4
37.0	Nottely River, mouth, south side, nail in root of willow tree	1,456.93
38.0	Small rapids, water surface	1,448
39.0	Beech Creek, water surface	1,438
40.5	Ford, water surface	1,425
40.5	Shallow ford, 40 feet southwest, honey bee tree, nail in root	1,431.59
41.2	Water surface	1,418
42.0	Grape Creek, mouth, water surface	1,416
42.5	Small shoals, head, water surface	1,415
42.5	Foot of small shoals, water surface	1,410
42.9	Water surface	1,406
44.1	Persimmon Creek, mouth, water surface	1,391
44.8	Foot of large shoals, point on rock	1,390.24
44.8	Water surface	1,381
45.0	Head of small shoals	1,379
46.2	Dennest Creek, mouth, water surface	1,365
46.9	Point on rock	1,363.58
48.0	Shoals, water surface	1,346
48.8	Robertson Ferry, 100 feet below, point on rock	1,344.23
48.8	Robertson Ferry, water surface	1,343
49.9	Shoals, water surface	1,340
50.4	Creek, mouth, water surface	1,332
50.6	Water surface	1,329
51.2	Chamber Creek, mouth, water surface	1,324
51.2	20 feet north of bank, point on rock	1,327.94
51.8	Opposite island, water surface	1,318
52.5	Beaverdam Creek, mouth, water surface	1,304
53.0	Opposite island, water surface	1,296
53.9	Laurel Creek, mouth, water surface	1,290
54.3	Shoals, water surface	1,285
54.3	Foot of shoals, water surface	1,277
54.8	Water surface	1,269
55.2	Rapids, water surface	1,259
56.9	Anderson Creek, mouth, water surface	1,248
57.9	Water surface (15 feet above low water)	1,240
58.5	Shallow ford, 40 feet south, nail in root of gum tree	1,239.67
58.5	Water surface	1,234
58.5	High-water mark	1,241
58.6	Foot of small shoals, water surface	1,227

Elevations on Hiwassee River from Hiwassee, Ga., to Apalachia, N. C.—Contin

Distance.	Description of points.	
Miles.		
58.9	Shoals Creek, mouth, water surface	
59.7	Foot of small rapids, water surface	
60.9	Stream, mouth, water surface	
61.1	Cane Creek, mouth, water surface	
63.0	Water surface	
64.2	Camp Creek, mouth, water surface	
65.0	Kilpatrick Ferry, 12 feet south, willow tree	
65.0	Kilpatrick Ferry, water surface	
65.2	Taylor Ferry, 60 feet northwest, edge of bank, point on large rock	
65.2	Taylor Ferry, water surface	
66.8	Apalachia, N. C., Sugar Creek, mouth, 100 feet from post-office, 5 feet north of bank of river, tripple willow tree	
66.8	Apalachia, N. C., water surface	
66.8	High-water mark	

SURVEY OF NOTTELY RIVER.

The elevations in the following list are based upon a bronze t marked "1892 ATLANTA" in the foundation wall at northwest c of Union County Court-House, Blairsville, the elevation of wh accepted as 1,891.536 feet above mean sea level. The leveli adjusted with the Hiwassee River flying levels to accord wit 1903 adjusted elevation of primary bench marks at Blairsville Hiwassee. The leveling was done in 1903 by Thomas B. O'H levelman, under the direction of Carroll Caldwell, field assis United States Geological Survey.

Elevations on Nottely River from mouth to Blairsville.

Distance.	Description of points.	al
Miles.		
0.0	Junction of Nottely and Hiwassee rivers, on point of peninsula, nail in side of birch tree	
0.0	Water surface	
0.3	At lower ford, water surface	
0.3	75 feet north of lower ford, nail in hickory tree	
1.0	High-water mark	
1.0	Upper ford, 50 feet south, nail in root of oak tree	
1.0	Water surface	
1.3	Water surface	
1.5	Water surface	
1.5	Water surface	
1.8	Deep ford, 25 feet north, nail in root of black oak	
1.8	Water surface	
2.0	Water surface	
2.3	High water	
2.4	Head of shoals, water surface	
2.6	Water surface; rain during night raised water 1.3 feet, lower water surface 1,492.67	
2.9	Hall Bridge, 20 feet west, nail in side of apple tree	
2.9	Hall Bridge, water surface	
2.9	High water	
4.2	Davis Ford, 20 feet northwest, nail in side of maple tree	
4.2	Davis Ford, water surface	
4.9	Surface of water on rock	
5.2	Mouth of Coombs Creek, water surface	
5.4	Water surface	
5.5	Hall Ford, north edge of river, nail in side of water birch tree	
5.5	Water surface	
5.5	High water	
5.9	Mouth of branch, water surface	

Elevations on Nottely River from mouth to Blairsville—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
6.0	Water surface	1,521
6.6	Water surface	1,526
6.9	Opposite island, water surface	1,534
7.0	Mouth of Rocky Branch, water surface	1,535
7.1	Near old mill, water surface	1,538
7.5	Water surface	1,542
8.6	Nottely Bridge, 1,800 feet north, in old field near barn, nail in side of persimmon tree	1,559.54
8.6	Nottely Bridge, water surface	1,544
8.9	Nottely Bridge, 100 feet west, 5 feet south of road, nail in side of black oak tree	1,560.13
9.6	Water surface	1,547
10.5	Mouth of Johnson Branch, water surface	1,548
10.9	Water surface	1,551
11.5	Jacks Creek, 906 feet south, in bend of river 600 feet west and 600 feet north, in cornfield, nail in root of dead peach tree	1,571.83
11.5	Water surface	1,554
11.7	Water surface	1,555
12.0	Anderson Bridge, 50 feet west, nail in side of sycamore tree	1,565.78
12.0	Anderson Bridge, water surface	1,556
12.0	High water	1,575
12.2	Water surface	1,560
12.9	Mouth of branch, water surface	1,561
13.3	Ford, 20 feet northwest, nail in side of birch stump	1,574.02
13.3	Water surface	1,562
13.3	High water	1,577
14.2	Water surface	1,565
15.1	Water surface	1,568
15.4	Landermilk Ford, 1.4 miles below, opposite old fish dam, 50 feet west of river, near small branch, nail in root of black oak tree	1,586.77
15.4	Water surface	1,573
16.0	Water surface	1,580
16.8	Landermilk Ford, 100 feet southwest, 20 feet north of road, nail in root of apple tree	1,598.19
16.8	Water surface	1,583
16.8	High water	1,599
17.2	Mouth of Butler Creek, water surface	1,585
17.7	Below fish dam, water surface	1,587
17.8	Mouth of Moccasin Creek, water surface	1,588
17.8	Moccasin Creek, 200 feet south, 35 feet east of river, east side of road, nail in root of red oak tree	1,602.87
18.5	Mouth of branch, water surface	1,591
18.6	Mouth of Dooleys Creek, water surface	1,591
18.9	Thompson Bridge, 250 feet south, 100 feet southwest of road, nail in root of red oak tree	1,611.01
18.9	Water surface	1,592
18.9	High water	1,601.53
19.1	Water surface	1,599
19.6	In shoals, water surface	1,611
20.2	Above fish dam, water surface	1,617
20.4	Head of fish dam, water surface	1,619
20.8	Foot of island, in shoals, water surface	1,624
21.0	Water surface	1,630
21.4	Chapman Ford, 150 feet north, 2 feet east of road, nail in root of walnut tree	1,645.81
21.4	Water surface	1,634
21.4	High water	1,644
21.8	Just below fish dam, water surface	1,638
21.9	Mouth of Camp Creek, water surface	1,639
22.6	Above shoals, water surface	1,652
23.0	Mouth of Weasel Creek, water surface	1,655
23.6	Mouth of branch, water surface	1,656
23.8	In shoals, water surface	1,657
23.8	Chamber Ford, 0.4 mile northwest, northeast side of river, point on edge of rock	1,675.88
24.2	Chamber Ford, 200 feet west, nail in root of walnut tree	1,671.49
24.2	Water surface	1,661
24.2	High water	1,678
25.0	Above small shoals, water surface	1,669
25.2	Chastain Ford, 50 feet west, nail in side of walnut tree	1,683.45
25.2	Water surface	1,669
25.5	Foot of large shoals, water surface	1,675
25.8	Mouth of Ivy Creek, head of shoals, water surface	1,680
26.3	Near house, water surface	1,685
26.6	Majners Ford, 75 feet west, on edge of bank, nail in side of corn-bean tree	1,690.8
26.6	Water surface	1,687
26.8	Meadow Ford, 15 feet north, nail in root of beach tree	1,699.17
26.8	Water surface	1,689
26.8	High water	1,703
27.3	Huggins Ford, 25 feet north, nail in side of corn-bean tree	1,707.82
27.3	Water surface	1,692
27.5	Shoals	1,694
27.8	Water surface	1,698
27.9	Above shoals, water surface	1,698

Elevations on Nottely River from mouth to Blairsville—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
28.4	Morgan Ford, 40 feet north, red oak tree, water surface	1,714
28.4	Water surface	1,702
29.0	Mouth of Young Cour Creek, water surface	1,699
29.0	Mouth of Castile Creek, water surface	1,709
29.1	Castile Creek, 1,600 feet above, on rock, edge of river, point on rock	1,714.2
29.4	Above rapids, water surface	1,715
30.0	Above fish dam, water surface	1,718
30.3	McBee Ford, 60 feet north, nail in side of red oak tree	1,734.37
30.3	Water surface	1,721
30.8	Above branch, water surface	1,723
31.1	Mouth of Reeses Creek, water surface	1,724
31.4	Youngs Ford, 80 feet southwest, red oak tree	1,741.02
31.4	Water surface	1,727
31.5	Millburn Creek, just below, water surface	1,730
31.9	At canal, foot, water surface	1,732
31.9	Head of canal, water surface	1,735
31.9	Canal cut (cut has a drop of 3.6 feet) ,50 feet northeast of river, 15 feet southwest of ford, nail in root of red oak tree	1,741.26
32.2	Above small rapids, water surface	1,739
33.0	Mouth of creek, water surface	1,743
33.6	Watkins Bridge, 375 feet above, north edge of river, point on rock	1,747.54
33.6	Water surface	1,747
33.6	Jarrett mill dam, foot of	1,748
33.6	Jarrett mill dam, head (Jarrett mill dam has a drop of 3.79 feet)	1,752
34.5	Reeds Ford, 150 feet east, nail in root of walnut tree	1,766.24
34.5	Water surface	1,755
35.0	Above small rapids, water surface	1,760
35.9	Blairsville Bridge, 100 feet southeast, mouth of Butternut Creek, 15 feet north, nail in side of red-oak tree	1,775.94
35.9	Water surface	1,769
35.9	High water	1,783
37.2	Blairsville court-house, Union County, in wall on west side of building, bronze tablet	1,891.536

SURVEY OF TOCCOA RIVER.

The elevations in the following list are based upon an aluminum tablet at the Washington street entrance of the State capitol building at Atlanta, marked "1050 M. C.," the elevation of which is now accepted as 1049.546 feet above sea level. They accord with the 1903 adjusted elevations of primary bench marks near Morganton and Shallow Ford. The section, Shallow Ford to McCays Ferry, is a single spur line.

The leveling was done in 1903 by Thomas B. O'Hagan, levelman, under the direction of Carroll Caldwell, field assistant United States Geological Survey.

Elevations on Toccoa River from Butts Bridge down to the Tennessee line.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
0.0	Morganton (3 miles east of Dial), forks of Morgan and Ellijay road, in large marble rock, copper bolt marked "1981"	1,947.821
1.5	Butts Bridge, east side, nail in top of abutment	1,874.25
1.5	Butts Bridge, water surface	1,858
1.5	High-water mark	1,870
2.0	Pigeon Creek, 550 feet east;, north side of road, 60 feet north of river, point on rock	1,858.35
2.0	Mouth of Pigeon Creek, water surface	1,849
2.3	Between rapids, water surface	1,845
2.5	Foot of shoals, water surface	1,840
2.9	Mouth of Weeks Creek, foot of rapids, water surface	1,830

Elevations on Toccoa River from Butts Bridge down to the Tennessee line—Continued.

Distance.	Description of points.	Elevation above sea level.
Miles.		*Feet.*
3.1	Dial post-office, Van Zants Bridge, 100 feet north, east side of road, nail in root of red-oak tree	1,844.68
3.1	Water surface	1,828
3.1	High-water mark	1,851
4.0	Mouth of Noontootly Creek, water surface	1,825
4.0	Mouth of branch, water surface	1,821
4.2	Rogers Ford, 50 feet west, nail in root of tree	1,825.14
4.2	Water surface	1,820
4.7	Water surface	1,815
5.1	In rapids, water surface	1,813
5.2	Big Creek Ford, 225 feet southeast; 50 feet south of river, nail in root of white-oak tree	1,817.74
5.2	Water surface	1,810
5.2	In rapids, water surface	1,809
5.7	Above rapids, water surface	1,802
5.9	Below fish dam, water surface	1,799
6.1	Head of shoals, water surface	1,795
6.4	Foot of shoals, water surface	1,791
6.4	Water surface	1,790
7.0	Water surface	1,782
7.1	Shallow ford, 1 mile north, north side of road in large rock, copper bolt marked "1859"	1,826.439

SINGLE FLYING LEVEL SPUR LINE TO McCAY'S FERRY.

7.1	Below rapids, water surface	1,779
7.6	In rapids, water surface	1,769
8.1	Shallow ford, 100 feet north, nail in root of red oak	1,774.93
8.1	Water surface	1,763
8.1	High-water mark	1,774
8.3	In rapids, water surface	1,758
8.6	Water surface	1,755
8.8	Mouth of Stanley Creek, water surface	1,752
9.1	Rapids, water surface	1,747
9.3	Mouth of stream, water surface	1,743
9.5	Below rapids, water surface	1,738
9.9	Stanley Creek, 1 mile northwest, opposite island, north side of river, point on rock	1,738.77
10.0	In rapids, water surface	1,729
10.2	Opposite falls in river, 50 feet north of first falls, point on large rock	1,744.02
10.2	Head of falls, water surface	1,728
10.2	Foot of falls, water surface	1,719
10.7	Mouth of branch, water surface	1,717
11.0	Below rapids, water surface	1,709
11.2	Mouth of Flat Creek, water surface	1,705
11.5	In rapids, water surface	1,691
11.6	Water surface	1,690
11.8	Head of long shoals, water surface	1,689
11.8	Rock cliff, south side of river, opposite large shoals, point in side of	1,692.11
11.9	Head of island, in shoals, water surface	1,679
12.0	Foot of island, in shoals, water surface	1,677
12.9	In shoals, water surface	1,665
13.3	Foot of large shoals, water surface	1,659
13.4	Below rapids, head of more shoals, water surface	1,656
13.4	In rapids, water surface	1,646
14.0	Foot of shoals, water surface	1,640
14.6	Mouth of Persimmon Creek, water surface	1,633
14.6	Persimmon Creek, 300 feet east; west side of river, nail in root of large dead stump	1,638.06
14.7	Below fish dam, water surface	1,629
15.2	Mouth of stream, water surface	1,624
15.4	Mouth of Wilscot Creek, water surface	1,624
15.8	In shoals, water surface	1,616
16.0	Foot of shoals, water surface	1,609
16.8	In rapids, water surface	1,602
16.8	Wilscot Creek, 1.5 miles west; rock cliff, 18 feet north of river, point on very large rock	1,608.96
16.9	In shoals, water surface	1,600
17.1	Foot of shoals, water surface	1,596
17.3	Tarpley Ford, water surface	1,593
17.3	Tarpley Ford, 20 feet west of; nail in root of beech tree	1,598.30
17.6	In rapids, water surface	1,589
18.2	Mouth of creek, water surface	1,576
18.3	Water surface	1,571
18.8	Mouth of creek, water surface	1,568
19.0	Mouth of Bullfrog Creek, water surface	1,565
19.6	Water surface	1,559
20.0	Mouth of Charlie Creek, water surface	1,555

Elevations on Toccoa River from Butts Bridge down to the Tennessee line—Co

Distance.	Description of points.
Miles.	
20.0	Lovingood Ford, 300 feet northwest, nail in side of walnut tree
20.0	Water surface
20.0	High-water mark
21.5	Mouth of Starr Creek, water surface
21.6	Below fish dam, water surface
22.0	Mouth of Rogers Branch, water surface
22.4	Toccoa Bridge, water surface
22.4	Toccoa Bridge, 10 feet east, nail in root of beech tree
22.9	Mouth of spring stream, water surface
23.5	Below small rapids, water surface
23.6	Mouth of Weavers Creek, water surface
23.9	Benchlog Ford, 20 feet northwest, nail in side of beech tree
23.9	Water surface
25.2	Large bend in river, water surface
25.5	Atlanta, Knoxville and Northern Railroad bridge, east side of bridge abutment point on rock
25.5	Water surface
25.5	High-water mark
26.6	Mouth of branch, water surface
26.8	Harts Ford, 100 feet west, stump on edge of bank at canoe landing, nail in side of
26.8	Water surface
28.0	Water surface
28.8	Baker Ford, 100 feet southwest, on edge of bank, nail in side of birch tree
28.8	Water surface
29.6	Water surface
30.0	Bend of river, water surface
30.2	Water surface
30.9	Mouth of Sugar Creek, water surface
30.9	Sugar Creek Railroad bridge abutment, point in center of east side of bridge
31.2	Below Calloway Ford, water surface
31.5	In shoals, water surface
32.1	200 feet northwest of ford, 4 feet southeast of Atlanta, Knoxville and Northern Railroad track, nail in side of peach tree
32.1	Water surface
32.5	Canoe landing, water surface
32.8	Hothouse Creek, mouth of, water surface
33.7	Foot of small shoals, near island, water surface
34.0	Mouth of Barker Creek, water surface
34.5	Kyle post-office, 600 feet east, Atlanta, Knoxville and Northern Railroad bridge over Barkers Creek, on southeast end of end bolt
34.6	Kyle post-office, 40 feet south, in front of Queen Brothers' store, pile supporting platform, nail in top of
34.6	Kyle Ford, water surface
35.0	Below rapids, water surface
35.4	Mouth of Wolf Creek, water surface
35.8	Atlanta, Knoxville and Northern Railroad bridge over Okoee River, east side of bridge, point on abutment
35.8	Water surface
36.1	In bend of river, water surface
36.3	Dillbeck Ford, north edge of river, nail in side of dead birch tree
36.3	Water surface
37.5	McCays post-office, Polk County, Tenn., rock supporting southwest corner of, point on
37.5	McCays Ferry, north side of river, pile supporting swinging bridge, cartridge shell in top
37.5	Water surface
37.5	High-water mark

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KENNEBEC RIVER BASIN, MAINE

BY

H. K. BARROWS

WITH A SECTION ON THE

QUALITY OF KENNEBEC RIVER WATER

BY

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WATER RESOURCES OF KENNEBEC RIVER BASIN.

By H. K. BARROWS.

INTRODUCTION.

Kennebec River with its important tributaries furnishes some of the best water power in the country, besides affording many excellent sites for further development. In extending in the best manner the use of this river and its branches for water power, for log driving and lumbering, and for municipal and other purposes, the welfare of the whole State of Maine is vitally concerned. A large amount of information of value in the study of this drainage basin has been gathered at various times, but much of it is scattered through various manuscripts and reports and is not readily accessible. This paper has been prepared in response to the constant demand for this information from both engineers and the public. Especial attention has been given to the subject of water storage, as this is of the utmost importance to present and future users of the water and the natural opportunities for regulating and improving flow in this basin are exceptionally good.

As a result of cooperation between the Maine State Survey Commission and the United States Geological Survey, the main river from Skowhegan to The Forks was surveyed during 1904, and surveys of various lakes and ponds in the headwater region were made during 1905–6 by the National Survey. The following plans and profiles will be furnished to persons especially interested in the subject on application to the Director, United States Geological Survey, Washington, D. C.:

Plan and profile of Kennebec River from Skowhegan to The Forks.
Plan of Brassua Lake.
Plan of Brassua Lake Outlet.
Plan and profile of Moose River between Moosehead and Brassua lakes.
Plan of Wood and Attean ponds.
Plan of Wood Pond Outlet.
Reconnaissance plan of Holeb Pond, Long Pond, Lower Roach Pond, Middle Roach Pond, Flagstaff Lake, West Carry Pond, Spring Lake, and Spencer Ponds.

Topographic maps[a] of a large portion of the Kennebec basin have

[a] These maps may be obtained for 5 cents each by addressing the Director of the United States Geological Survey, Washington, D. C.

been published by the United States Geological Survey. The u survey adopted is a rectangular area bounded by meridians an allels. Such an area is known as a quadrangle and in Maine minutes in extent each way and has an area of one-sixteenth square degree. The quadrangles disregard political boundarie as those of States, counties, and townships. To each is give name of some well-known place or feature within its limits. areas surveyed in the Kennebec basin and the names of the rangles are shown in fig. 1.

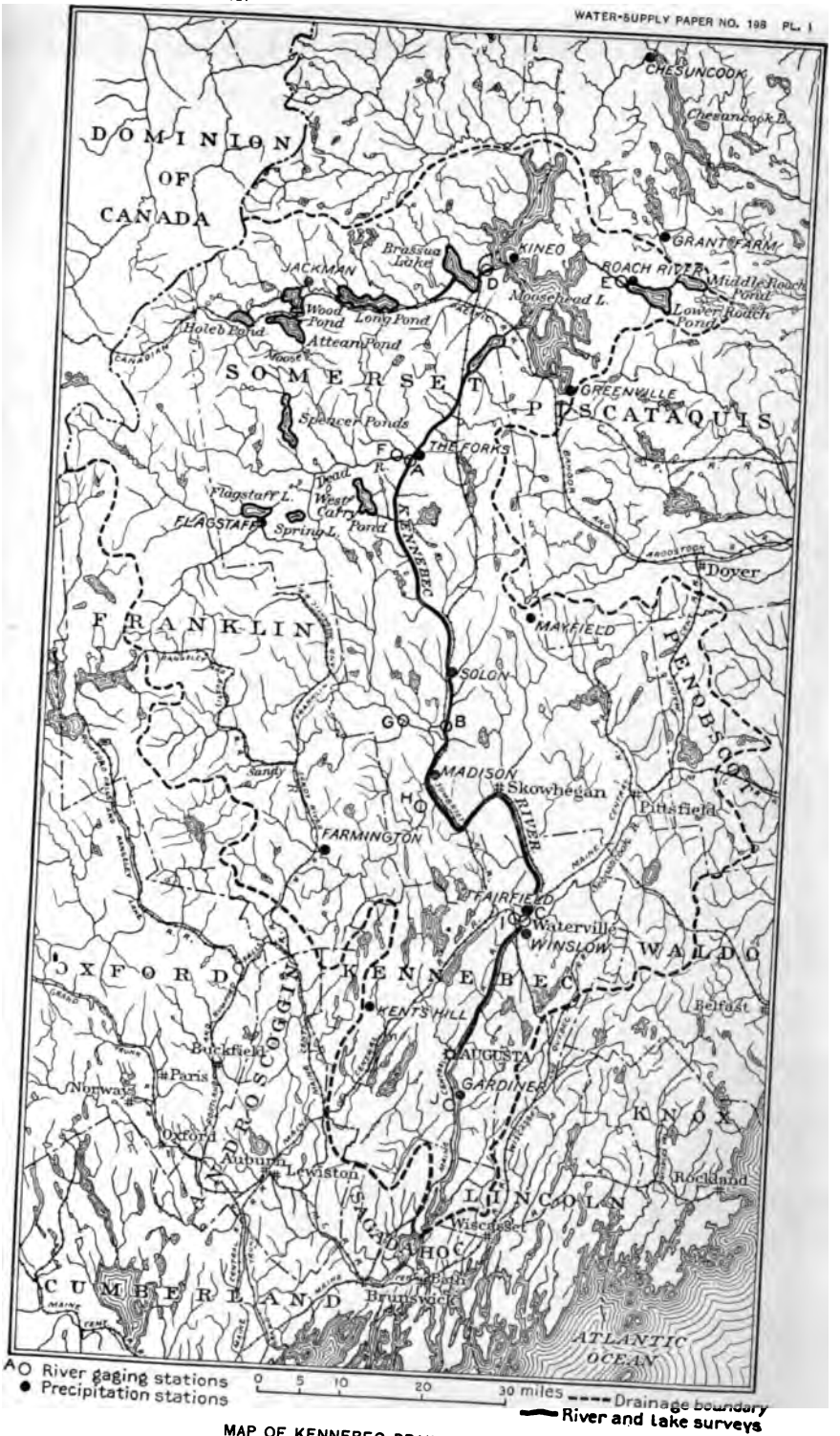
The present report has been compiled chiefly from the re reports, and maps of the United States Geological Survey, alt much valuable information has been furnished by private p Primarily this report is made possible at this time by the coope of the State of Maine, through its State Survey Commission, M Leslie A. Lee, chairman; Charles S. Hichborn, secretary and trea and William Engel. Special acknowledgment is also due to the Ho worth & Whitney Company, of Waterville, through F. E. Boston, and James L. Dean, engineer, for data on flow at Waterville, on M head Lake, and on floods in Kennebec River; to the Kennebec Power Company, through W. H. K. Abbott, secretary and trea and Fred T. Dow, engineer, for much information regarding M head Lake and Kennebec River; to the Kennebec, Moose, and River Log-Driving Companies, through S. W. Philbrick, secr and treasurer, for information regarding log driving, improvei of river, etc.; and to Prof. A. D. Butterfield, of the Universi Vermont, who gathered much of the new matter for this report

GENERAL DESCRIPTION OF BASIN.

PHYSICAL CHARACTERISTICS.

Kennebec River rises in Moosehead Lake, in the west central of Maine, the headwaters being collected by Moose River, E River, and a number of smaller streams rising in the hilly, for areas east and west of the lake. The drainage basin (Pl. I) ex from the Canada line to the ocean, measures about 150 miles in le varies in width from 50 to 80 miles in the main portion, and emb a total area of 5,970 square miles (about one-fifth the total area State), of which 1,240 square miles are tributary to Moosehead L The length of the river from the lake to the entrance of Merry ing Bay, including the more considerable windings, is about miles.

The northern part of the drainage basin is broken by offsets the White Mountains, and nearly the whole upper portion is f covered and in its original wild state. Near Moosehead Lake hills and highlands lie well back from the lake, leaving a great



MAP OF KENNEBEC DRAINAGE BASIN.

Showing gaging and rainfall stations and river and lake surveys.

plain; below the outlet of the lake into the Kennebec the hills close in on the river, forming a narrow, rocky chasm, with steep, precipitous

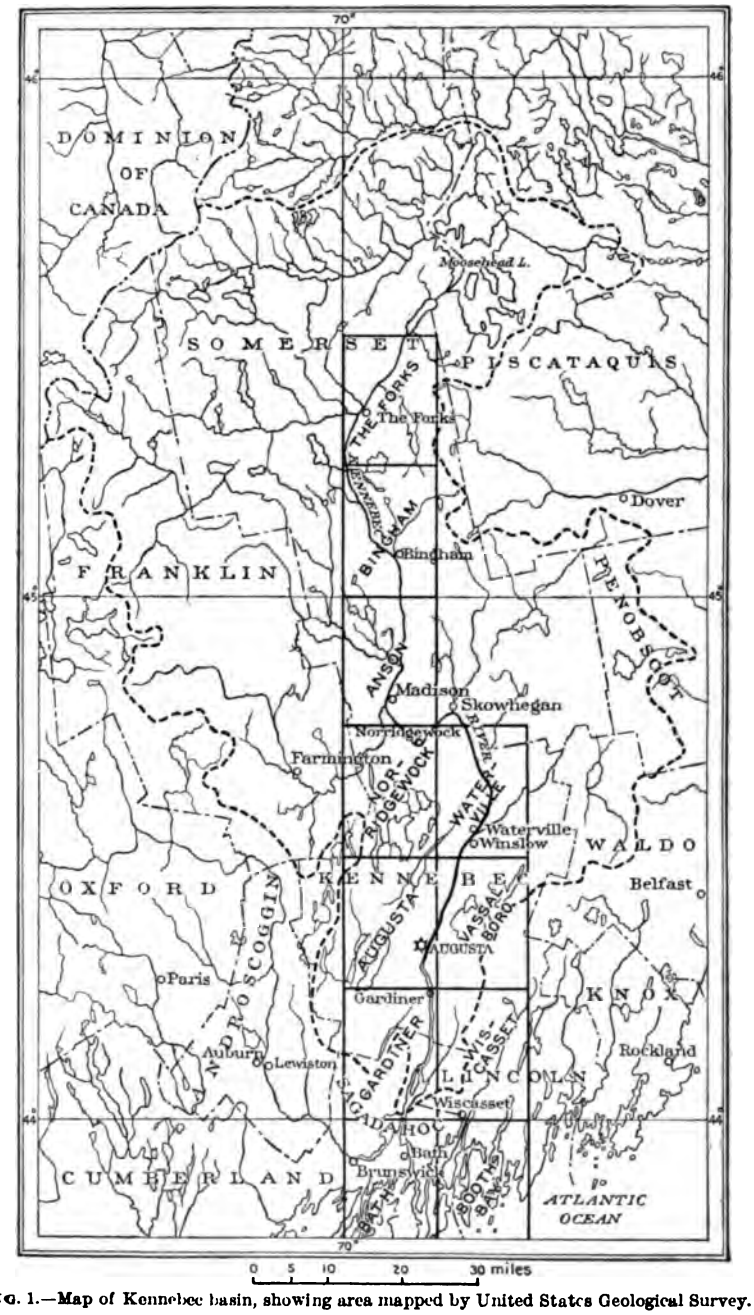


FIG. 1.—Map of Kennebec basin, showing area mapped by United States Geological Survey.

les. From Moosehead Lake to the upper end of Indian Pond, a tance of about 4.5 miles, there is a fall of about 90 feet, this being a

very rough, rocky, and turbulent part of the river. Indian varies in width from a few hundred feet to about three-fourth mile, and has a total length of about 5 miles. It has two levels rated by a short stretch of rapids at the "narrows," about a mi the upper end of the pond, where there is ordinarily a fall of a feet. From Indian Pond to The Forks the river is a torrent, over a rough and rocky bed more than 350 feet in a distance o 15 miles. Below the Forks, where it is joined by the waters o River, the Kennebec flows through a broader valley whose slopes are still covered to some extent with forest growth. Al miles from the coast the hills again rise, though not to any co able height. The general elevation of the basin is less than the Androscoggin, which adjoins it on the west, though near the of the area Saddleback, Abraham, and Bigelow mountains isolated peaks to an elevation higher than any mountains in th except Katahdin.

The fall of the river from Moosehead Lake to the head of tid at Augusta is 1,026 feet, the distance being 120 miles and the a descent 8.55 feet per mile.

GEOLOGY.

By GEORGE OTIS SMITH.

The water resources of a drainage basin are to a large extent d ent on the geology of the area. The geologic factors that are of importance in influencing the present drainage conditions of th nebec basin are the rock structure and the processes of land e that have produced the present configuration of the surface, represents one stage in the topographic development as shown amount of relief and its details. All of these details are the pr of past geologic processes and constitute the record of geologic h Most, if not all, of these conditions directly affect the character drainage system and largely control the availability and perma of its water resources, thus showing the intimate relation betwe geologic work of the past and the industrial activity of the pres

The Kennebec basin presents considerable variety in its rock f tions. In the northern part of the basin the rocks are of later zoic age and include sandstones, conglomerates, shales, slate impure limestones, these sedimentary rocks in several localities fossiliferous. Within this area there are also some masses of vo rocks, of which the porphyritic rhyolite of Mount Kineo furnish most conspicuous exposure. The sedimentary rocks of this p of the Kennebec basin have a general northeast-southwest tren it is not known that the geologic structure has any marked inf on the topography except where certain more massive and res strata may control the position of minor ridges. To the nort the divide between the Kennebec waters and the drainage o *Chaudiere* is probably determined in part by the presence of

older schists which have withstood erosion more effectively than the sediments of the Moosehead region.

South of The Forks the rocks of the Kennebec basin include roofing slates similar to those quarried in Piscataquis County, other argillaceous rocks, impure limestones, and calcareous sandstones. Associated with these sedimentary rocks are several areas of intrusive granite, the largest of which is on the headwaters of Dead, Carrabassett, and Sandy rivers. The general trend of the formations in this part of the basin is also northeast and southwest, and the river gorge cuts across several ridges whose position appears to be determined by rock structure.

South of Augusta the rocks are sedimentary in origin and were once similar to those just described, but have been altered into slates, schists, and gneisses, which are thoroughly impregnated with pegmatitic and granitic material. So complex is the character of this widespread intrusion that in many places it is difficult to distinguish between the schist or gneiss and the granite. The quarries at Hallowell are located on one of the larger masses of pure granite.

A noticeable characteristic of all the rocks mentioned above is their compactness and hardness. Not only is this due to their age, but more especially to the degree of their alteration. During the ages that have elapsed since their deposition they have undergone important changes by which soft mud rock or shale has been metamorphosed into crumpled schist, and loose-textured sandstone into flintlike quartzite. This has been effected both by the intrusion of large masses of molten granite and by the folding of beds that were originally horizontal but are now steeply inclined. Similar rock folds characterize deeply eroded mountain masses, and here the rocks may have been elevated into ridges. Of these ridges the lower portions alone remain, and any suggestion of their existence is furnished only by the closely folded beds of rock that line the stream bank in so many localities.

These hard and compact rocks give to the present channels of the Kennebec and its principal tributaries a permanence which they might not possess if the rocks were softer. The complicated structure of the rocks and the consequent alternation of relatively hard and soft beds control to a large extent the abrupt changes in the grade of the streams where rips and falls succeed quiet reaches.

The topography of the region drained by Kennebec River is the resultant of a long-continued process of erosion or land wear in which normal weathering and stream work have been the most important elements. The agency that has been most active in the production of the present land forms is running water, and the topography of the basin is to be considered as largely the product of the activity of Kennebec River and its many tributary streams. Glacial erosion and deposition *have also contributed* to the production of the present

land surface, with the result that in certain areas the relief in its details is due largely to glacial processes rather than to river work.

The differences between the topography of this region at the beginning of the Pleistocene or glacial epoch and that at its close are doubtless great and are of special interest in the present connection. It is probable that before the first invasion of the ice the hills and mountains of this basin rose more abruptly above the valleys, and that the Kennebec and its principal tributaries meandered over relatively wide valley floors instead of being confined between terraces as at present. In the valleys firm rocks were exposed in few places, probably, and residual soils and clays formed a deep cover where to-day there are ledges of solid rock or benches of gravels, sands, and clays. The first effect of the occupation of the basin by the ice sheet from the north was the planing away of the decomposed rock and the smoothing down of the outlines of the hills and mountains. A consequence of this planing action of the ice is the presence to-day of firm rock foundations that afford opportunity for the erection of mill structures and dams whose safety is insured against destruction by freshets.

The detritus produced by this glacial erosion furnished in turn the material transported in the ice and the mass of gravel, sand, and finer material transported by the streams flowing on the surface of the glacier, beneath it, or over the land surfaces beyond its margin. All this material was deposited at various points within this area or in the submarine extension of this basin. The subsidence of the land during the later stages of the glacial epoch caused an advance of the sea northward along the Kennebec Valley to a distance of 100 miles or more from the present coast line. In the quiet waters of the estuary thus produced the glacial streams deposited their loads, and from these deposits have resulted many of the present topographic forms, such as the terraces, sand plains, and kettle basins, which are familiar to those who traverse the Kennebec Valley. The glacial deposits, however, affect more than the scenery. The preglacial Kennebec drainage system was greatly altered, and not only were old channels filled with bowlder clay and with glacial gravel and sand, but the streams, thus diverted at a time when their volume and load were greatly increased by the contribution from the melting glacier, were compelled to cut new channels, which in many cases followed courses quite different from the old. This resulted in the transfer of drainage from one river system to another and, what is more important, the creation of waterfalls. The stream, thus forced to abandon a valley that probably was relatively wide and possessed a moderate grade, now cuts across a rock divide, where it develops a waterfall. When the drainage history of the Kennebec basin is thoroughly worked out it will be found that there have been many such stre

diversions, which have resulted in the development of water powers that now constitute one of the most valuable assets of the State.

One of the more conspicuous cases of probable stream diversion that can be cited is that of Sandy River. This stream flows almost due north where it enters the southward-flowing Kennebec a short distance below Madison. This abnormal relation between the two rivers points to the existence of diversion, and it seems probable that in preglacial time the drainage from the Sandy River basin flowed in a different direction and entered Androscoggin River in the vicinity of Jay. Through obstruction of the lower course of the Sandy by glacial deposits the channel south of the present site of Farmington seems to have been abandoned and the stream forced to seek an outlet to the east. The position of the abandoned portion of the Sandy River Valley is indicated in the present topography, and like many other such abandoned valleys this one has been utilized by the railroad engineer, being followed approximately by the Farmington branch of the Maine Central. The water powers at Farmington and Farmington Mills may be regarded as owing their origin to this stream diversion. It is also possible that a part of the present drainage basin of Dead River was once tributary to the Sandy, but was likewise diverted by glacial deposits during the retreat of the ice. This supposition is based principally on the abnormal course of the lower part of Dead River and the presence there of rapid water and falls, in strong contrast with the upper reaches which give the name to the river.

Not only are there in the Kennebec basin such cases of diversion of former tributaries of other river systems as that just cited, but the Kennebec itself seems to possess a somewhat complex character. It now occupies portions of the valleys of streams that were formerly tributaries. There is reason to believe that the portion of the Kennebec north of Norridgewock formerly flowed more nearly southward from that point and united with the drainage of Wesserunsett and Carrabassett streams and Sebasticook River at some point south of Waterville. If this is true, then that portion of the Kennebec between Norridgewock and Skowhegan, with its abnormal northeasterly course, represents the diversion of the upper Kennebec eastward to the point where it joined the valley of the Wesserunsett below Skowhegan. This change in the river's course can doubtless be attributed to the thick deposits of glacial gravels and sands in the western part of the town of Norridgewock, where in fact the low divide between the streams flowing directly into the Kennebec and those tributary to the Smithfield ponds and Messalonskee Stream is relatively close to the main river at Norridgewock. In a similar way the Messalonskee drainage seems to have been itself diverted from its original course, so that this stream is turned northward nearly to the point of its junction with the Kennebec. Another stream whose

present abnormal course suggests similar diversion is the Cob
contee. The result of all these diversions has been to create v
water powers. These drainage changes, examples of which
peculiar to the Kennebec basin but are common throughout
Maine, might be described with greater detail had fuller stuc
made of this interesting subject. The statements made abo
however, sufficient to indicate to what a large degree the
wealth of available water powers in the Kennebec basin is th
of the glacial history of the region.

A hardly less important result of the glaciation has been the
tion of the numerous lakes and ponds that are so character
almost the whole of the Kennebec basin. As has been point
the original system of drainage was so modified by the distribu
glacial deposits as hardly to be recognizable in the present
arrangement, and with this stream adjustment is connect
origin of these ponds and lakes, the total area of whose water
is very great, as is shown in other portions of this report. The
ditions are extremely important in their economic bearing,
ponds and lakes, together with extensive swamps, constitute
storage system by which the water supply is held in reser
rather indirect communication which many of these natural
voirs have with the main river serving to hold back the water
what in times of freshets. So it is that the glacial occupation
drainage basin is responsible not only for the creation of most
Kennebec water powers, but also for the constancy of the flow

The existing topography, as has been shown above, is the re
modification of an earlier topography by the different geologi
esses. Although the present seems to the casual observer t
period of equilibrium and quiet so far as these geologic proces
concerned, in reality this may not be the case, so silent an
moving are these natural forces. It is therefore of interest to s
the stage in topographic development which has been reached
present time. As might be expected, different portions of th
nebec Valley exhibit quite different characters; thus the broad
along the lower courses of the river is in marked contrast wi
canyon occupied by the stream north of Bingham. The cany
character of the valley of the upper Kennebec is all the more
able because of the type of upland topography to be seen a few
east of the river. This upland is suggestive of a topography
is much older than that represented by the gorge through whi
river runs. Thus it may be said that this part of the Kennebe
exhibits both the mature topography of the upland and the yo
topography of the canyon. This suggests that the regio
reached the stage of maturity in one cycle of its history and h
entered on the first stage in a later cycle.

The amount of relief within the Kennebec basin is considerable, although the highest mountains in the State are not included within this basin. Its highest peaks are those about the headwaters of Dead and Sandy rivers, the more prominent being Mount Bigelow, Mount Abraham, and Saddleback, and the peaks along the divide between the Kennebec and Piscataquis waters, as well as Mount Kineo. South of Moosehead Lake the upland has a general elevation between 1,000 and 1,400 feet, above which rise peaks to elevations of 2,000 to 3,000 feet. In this area the elevation of the river in the gorge is between 500 and 900 feet. Farther south the contrasts of relief are much less. The presence of the extensive elevated regions in the northern part of the basin directly affects the amount of precipitation and of forest cover within this region.

In short, in the Kennebec basin the geologic structure, the geologic processes that have controlled the evolution of the present topography, the amount of relief, and the details in the land forms all contribute to the permanence and value of the water resources described on the following pages.

DRAINAGE.

There are, according to Wells,[a] 1,084 streams in the Kennebec basin. The most important of these tributary streams are listed in the following table:[b]

Principal tributaries of Kennebec River.

- Squaw Brook.
- Roach River—Lazy Tom Brook.
- Norcross Brook.
- Carry Brook.
- Williams Stream.
- Moose Brook.
- Socatean River.
- Tomhegan Stream.
- Baker Brook.
- Moosehead Lake
  - Barrett Brook.
  - Horse Brook
    - Beaver Brook.
    - Moose Brook.
  - Wood Stream.
  - Gander Brook.
  - Henson Brook.
  - Moose River
    - Upper Churchill Stream.
    - Lower Churchill Stream.
    - Parlin Stream.
    - Stony Brook.
    - Tom Fletcher Stream.
    - Brassua Stream.
    - Miseree Stream.

[a] Wells, Walter, The Water Power of Maine, 1869, p. 91.

[b] For descriptions of streams, ponds, and lakes in the following lists see Gazetteer at end of this paper.

- West Outlet Moosehead Lake—Churchill Stream.
- Indian Stream.
- Chase Stream.
- Cold Stream—Alder Stream.
- Moxie Stream
  - Sandy Stream.
  - Mosquito Stream.
  - Baker Stream.
- Dead River
  - North Branch
    - Bear Brook.
    - Clearwater Brook.
    - Indian Stream.
    - Cold Brook.
    - Alder Stream—Little Alder Stream.
    - Tim Brook.
  - South Branch
    - Redington Brook.
    - Black Brook.
    - Stratton Brook.
  - Reed Brook.
  - Bog Brook.
  - Spencer Stream
    - Kibby Stream.
    - Little Spencer Stream.
  - Enchanted Stream—Bitter Brook.
  - Gulf Stream.
  - Salmon Stream.
- Mink Brook.
- Bean Brook.
- Kelly Brook.
- Holway Brook.
- Pleasant Pond Stream.
- Carney Brook.
- Decker Brook.
- Whitcomb Brook.
- Houston Brook—Little Houston Brook.
- Austin Stream
  - South Branch—Ritt Brook.
  - Gulf Stream.
  - Heald Stream—Little Heald Brook.
  - Chase Stream—Bassett Brook.
  - Mink Brook.
- Jackson Brook.
- Martin Stream—Mill Stream.
- Fall Brook.
- Michael Stream.
- Carrabassett River
  - Houston Brook.
  - Poplar Brook.
  - Hammond Brook.
  - Rapid Stream.
  - Sandy Stream
    - East Brook.
    - Rowe Pond Stream.
    - West Brook.
    - Stony Brook.
    - Michael Stream.
    - Alder Stream.
  - Mill Stream—Witham Brook.

Sandy River
- Beaver Dam Brook.
- Wilson Stream.
- Bog Stream.
- Lemon Stream.

Bombazee Brook.
Mill Stream.
Turner Brook.
Wesserunsett Stream.
Carrabassett Stream—Black Stream.
Sebasticook River—Fifteen-mile Brook.
Messalonskee Stream—Belgrade Stream.
Bond Brook.
Cobbosseecontee Stream.
Togus River.
Rolling Dam Brook.
Eastern River.
Abagadassett River.
Cathance River.
Muddy River.
Nequasset Brook.

Wells states that there are 311 lakes and ponds in the basin.[a] The largest and most important are listed below:

Principal lakes and ponds in the Kennebec basin.

CONNECTED WITH MOOSEHEAD LAKE.

Fitzgerald Pond.	Trout Pond.
Prong Pond.	Spencer Pond.
Roach Ponds (3).	Tomhegan Pond.

CONNECTED WITH MOOSE RIVER.

Indian Pond.	Long Pond (Jackman and Long Pond townships).
McKinney Pond.	Fish Pond.
Holeb Pond.	Muskrat Pond.
Turner Ponds (2).	Mud Pond.
Toby Ponds (3).	Ironbound Pond.
Attean Pond.	Parlin Pond.
Moores Pond.	Long Pond (Parlin Pond Township).
Wood Pond.	Smith Pond.
Little Big Wood Pond.	Brassua Lake.
Benjamin Ponds (3).	Luther Pond.
Sally Pond.	Miseree Pond.
Ponco Ponds (2).	
Heald Pond.	

[a] Op. cit., p. 93.

CONNECTED WITH DEAD RIVER.

North Branch of Dead River:
- South Boundary Pond.
- Northwest Boundary Pond.
- North Boundary Pond.
- Horseshoe Pond.
- Otter Pond.
- Round Pond.
- Natanis Pond.
- Little Pocket Pond.
- Long Pond.
- Bog Pond.
- Lower Pond.
- Viles Pond.
- Chase Pond.
- Blanchard Pond.
- Bear Pond.
- Round Mountain Lake.
- Snow Pond.
- Greenbush Pond.
- Shallow Pond.
- Jim Pond.
- Little Jim Pond.
- Tim Pond.
- Barnard Pond.
- Welhern Pond.
- Tee Pond.

South Branch of Dead R
- Saddleback Ponds (
- Dead River Pond.
- Redington Ponds (3
- Long Pond.

Spencer Stream:
- Rock Pond.
- Iron Pond.
- Baker Pond.
- Spectacle Pond.
- Long Pond.
- Bartlett Pond.
- Horseshoe Pond.
- Parker Pond.
- Spencer Ponds (3).
- Whipple Pond.
- Hall Pond.

Dead River proper:
- Flagstaff Lake.
- Butler Ponds.
- Deer Pond.
- Spring Lake.
- Carrying Place Ponds
- Alder Pond.

CONNECTED WITH AUSTIN STREAM.

- Austin Ponds.
- Little Austin Pond.
- Withee Pond.
- Heald Ponds (3).
- Chase Pond.
- Chase Bog Pond.
- Mink Ponds (2).

CONNECTED WITH CARRABASSETT RIVER.

- Dutton Pond.
- Tufts Pond.
- Grindstone Pond.
- Indian Pond.
- Lily Pond.
- Middle Carrying Place Pond.
- Rowe Ponds.
- Beans Pond.
- Brandy Pond.
- Gilman Pond.
- Judkins Pond.
- Butler Pond.
- Embden Pond.
- Hancock Pond.
- Spruce Pond.
- Fahi Pond.
- Sandy Pond.
- Mud Pond.
- Boynton Pond.

CONNECTED WITH SANDY RIVER.

- Sandy River Ponds (4).
- Locks Pond.
- Sand Pond.
- Chesterville Ponds.
- Norcross Pond.
- Wilton Pond.
- North Pond.
- McGurdy Pond.
- Clear Water Pond.

CONNECTED WITH WESSERUNSETT STREAM.

Weeks Pond.
Wyman Pond.
Wentworth Pond.
Savage Pond.
Hayden Lake.

CONNECTED WITH SEBASTICOOK RIVER.

Moose Pond.
Barker Pond.
Starbird Pond.
Stafford Pond.
Mill Pond.
Indian Pond.
Little Indian Pond.
Rogers Pond.
Weymouth Pond.
Palmyra Ponds (2).
Whites Pond.
Sebasticook Lake.
Hicks Pond.
Nokomis Pond.
Corinna Ponds (2).
Dexter Pond.
Stetson Pond.
Plymouth Ponds (2).
Skinner Pond.
Unity (Twenty-five Mile) Pond.
Sandy Pond.
Lovejoy Pond.
Pattee Pond.
China Lake.

CONNECTED WITH MESSALONSKEE STREAM.

Messalonskee Lake.
Ward Pond.
Moose Pond.
Long Pond.
Beaver Pond.
Kidder Pond.
Great Pond.
Ellis Pond.
McGrath Pond.
North Pond.
Little Pond.
East Pond.

CONNECTED WITH COBBOSSEECONTEE STREAM.

Pleasant Pond.
Loon Pond.
Horseshoe Pond.
Purgatory Pond.
Sand Pond.
Buker Pond.
Jimmy Pond.
Sanborn Pond.
Jamies Pond.
Cobbosseecontee Pond.
Richard Pond.
Shed Pond.
Lake Annabessacook.
Wilsons Pond.
Cochnewagon Pond.
Dexter Pond.
Berry Pond.
Narrows Pond.
Carlton Pond.
Lake Maranacook.
Greeley Pond.

CONNECTED WITH KENNEBEC RIVER.

Moosehead Lake.
West Outlet Ponds (3).
Indian Pond.
Burnham Pond.
Big Indian Pond.
Little Indian Pond.
Ten Thousand Acre Ponds.
Island Pond.
Ellis Pond.
Dead River Pond.
Long Pond (T. 1, R. 6).
Wilsons Pond.
Knights Pond.
Black Brook Pond.
Fish Pond.
Cold Stream Pond.
Moxie Pond.
Mosquito Pond.
Baker Pond.
Mountain Pond.
Dimmick Ponds (2).
Pierce Pond.
Otter Ponds (2).
Pleasant Pond.
Robinson Pond.
Doughnut Pond.
Carrying Place Pond.
Decker Ponds.

Youngs Pond.
Emerton Ponds.
Turner Pond.
Mill Pond.
Merrill Pond.
Jackson Pond.
Sebleys Pond.
Long Pond (Hartland Township).
Lake George.
Oak Pond.
Weber Pond.
Threemile Pond.
Spectacle Pond.
Dam Pond.
Tolman Pond.
Togus Pond.
Threecornered Pond.
Greeley Pond.
Nehumkeag Pond.
Bradley Pond.
Nequasset Pond.

The following table, compiled from the Tenth Census, vol. publications of the United States Geological Survey, and from maps obtainable, shows the drainage area at different point Kennebec River and its tributaries:

Drainage areas of Kennebec River and its tributaries.

Stream.	Point of measurement.
Kennebec River	Outlet Moosehead Lake
Do	The Forks gaging station above mouth of Dead River
Do	Below and including Dead River
Do	Solon dam
Do	North Anson gaging station above mouth of Carrabassett River.
Do	Below and including Carrabassett River
Do	Madison dam
Do	Above mouth of Sandy River
Do	Below and including Sandy River
Do	Skowhegan dam
Do	Somerset Mills, Fairfield
Do	Waterville, Hollingsworth & Whitney Co.'s dam above mouth of Sebasticook River.
Do	Below and including Sebasticook River
Do	Above mouth of Messalonskee Stream
Do	Below and including Messalonskee Stream
Do	Augusta
Do	Above mouth of Cobbosseecontee Stream
Do	Below and including Cobbosseecontee Stream
Do	Head of Merrymeeting Bay
Moose River	Outlet of Holeb Pond
Do	Outlet of Attean Pond
Do	Outlet of Wood Pond
Do	Outlet of Long Pond
Do	Outlet of Brassua Lake
Do	Gaging station at mouth
Roach River	Outlet of Upper Roach Pond
Do	Outlet of Middle Roach Pond
Do	Gaging station near Roach River at outlet of Lower Roach Pond.
Do	Mouth
Moxie Stream	Outlet of Moxie Pond
Do	Mouth
North Branch of Dead River	Above junction with South Branch
South Branch of Dead River	Above junction with North Branch
Dead River	Above mouth of Spencer Stream
Do	Below and including Spencer Stream
Do	Gaging station at mouth
Carrabassett River	Above mouth of Rapid Stream
Do	Below and including Rapid Stream
Do	Gaging station at North Anson
Do	Mouth
Sandy River	Phillips
Do	Farmington Falls above Wilson Stream
Do	Below and including Wilson Stream
Do	Gaging station near Madison
Do	Mouth
Sebasticook River	Outlet Moose Pond
Do	Near Pittsfield above East Branch
Do	Below and including East Branch
Do	Mouth
Messalonskee Stream	Gaging station at Waterville
Do	Mouth
Cobbosseecontee Stream	Gaging station at mouth

FOREST CONDITIONS.[a]

The upper portion of the Kennebec River drainage basin is heavily imbered, although extensive cutting has been going on for many ears. Spruce is the most abundant, but large quantities of poplar, aluable in the production of the best grades of paper, are found. here are approximately 2,350 square miles of timber land in the asin, and about 3,883,000,000 feet of spruce standing (1902) suitable or lumber and pulp. About one-third of all the lumber used in the tate for pulp and paper comes from the Kennebec basin, the remainer being almost wholly supplied by the forests of the Androscoggin nd Penobscot basins.

POPULATION AND INDUSTRIES.

The population of the northern half of the basin is in general conentrated in lumber camps and a few small towns, which exist for the urpose of distributing men and supplies for lumbering, but there is a parse farming population that caters to the needs of the lumbermen. n addition a considerable number of sportsmen live within the basin luring the season for fishing and hunting. The lower half of the basin s very generally in farming lands, but several towns are engaged in the collection of produce and distribution of supplies and in manufacturing. Notable among the manufacturing towns are Solon, Madison, Skowhegan, Waterville, Augusta, and Gardiner. The principal products are pulp, paper, lumber, and cotton and woolen goods.

The following table gives the population of some of the principal owns and cities, based on the census of 1900:

Population of principal cities and towns in Kennebec basin.

ugusta	11,683	Farmington	3,288
rdiner	5,501	Pittsfield	2,891
llowell	2,714	Newport	1,533
aterville	9,477	Norridgewock	1,495
irfield	2,238	Winslow	2,227
owhegan	4,266	Richmond	2,049
dison	2,764	Winthrop	2,088
on	996	Oakland	1,913
enville	1,117		

The river is one of the best streams in the United States for the velopment of water power, and the upper section is used largely for driving. The river is open during eight months of the year and navigable as far as Augusta to vessels drawing 10 feet. Several ies and towns obtain their water supplies from the river. The ice-ting industry is also of considerable importance. From the

[a] Fourth Rept. Forest Commissioner of Maine, 1902.

20-mile stretch between Augusta and Richmond, all within the navigable portion, many thousands of tons of ice are cut yearly and shipped for use in southern cities.

TRANSPORTATION FACILITIES.

Water transportation is available below Augusta. Rail transportation is provided by the Maine Central Railroad to points along the river south of Skowhegan; by the Somerset Railway, through its connection with the Maine Central at Oakland, to the middle and northern parts of the basin as far north as Bingham; and by the Canadian Pacific and Bangor and Aroostook railways, through their numerous connections with the Maine Central, to the northern part of the basin. An extension of the Somerset Railway, now being constructed, will when completed extend to Birch Point, on the shore of Moosehead Lake, opposite Kineo, forming a junction with the Canadian Pacific Railway near the west outlet of Moosehead Lake.

PRECIPITATION.

Precipitation stations have been maintained at the following places in the Kennebec River drainage area and its immediate vicinity. With the exception of those at Chesuncook, Grant Farm, and The Forks, which were established by the United States Geological Survey, these stations have been maintained by the United States Weather Bureau.

Rainfall stations in Kennebec basin.

	Approximate elevation above sea level (feet).		Approximate elevation above sea level (feet).
Chesuncook	950	Kents Hill	300
Fairfield	90	Kineo	1,050
Farmington	368	Madison	250
Flagstaff	1,400	Mayfield	1,300
Gardiner	100	Roach River	1,150
Grant Farm	1,000	Solon	350
Greenville	1,040	The Forks	590
Jackman	1,220	Winslow	80

In the northern and more remote parts of the basin considerable difficulty has been experienced in obtaining continuous records. The station at Gardiner (fig. 2), however, furnishes an unbroken record for more than fifty years (from 1839 to 1889).

In computing the mean monthly and yearly precipitation, where data are lacking for a few months only, they have been supplied from adjacent stations, as noted. It appears that the mean annual rainfall for selected stations is as follows:

Mean annual precipitation, in inches, in Kennebec basin.

Station.	Period of record.	For period.	1899–1905, inclusive.	1902–1905, inclusive.
Fairfield	1891–1905	34.46	36.82	35.39
Farmington	1891–1905	42.90	43.00	39.45
Flagstaff	1896–1901	38.48	.....	.....
Gardiner	1839–1888	44.73	42.59	40.16
Kineo	1895–1897, 1901–1902	35.72	.....	.....
Mayfield	1899–1905	43.31	43.31	42.63
The Forks	1902–1905	37.90	.....	.....
Winslow	1896–1905	38.87	39.31	37.29
Average	.....	39.55	41.01	38.98

The third column of the foregoing table gives a good idea of the amount of and variation in annual precipitation, although the stations are, of course, not very evenly placed and should not be weighted alike. Apparently the precipitation in the Kennebec basin

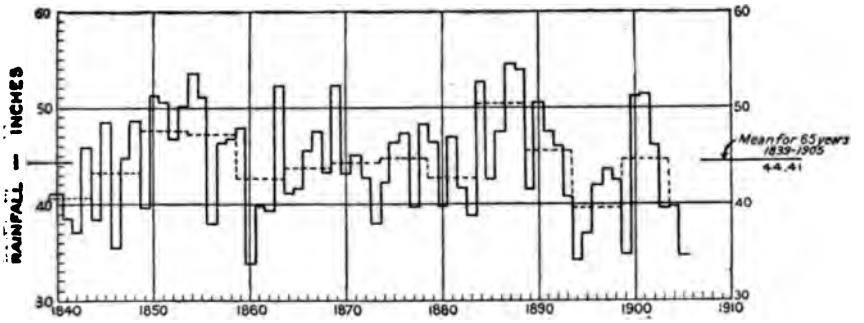


FIG. 2.—Mean annual precipitation at Gardiner, Me., 1839–1905. Records from 1860 to 1892 are mostly from Lewiston. Dotted lines show means for five-year intervals.

reaches a maximum of about 45 inches near the coast, as shown by the Gardiner records. There is a slight falling off farther inland, in the vicinity of Winslow and Fairfield, and then an increase (see Farmington and Mayfield records) to almost the same amount as near the coast. Probably there is a gradual decrease from these points northward, a minimum of between 30 and 35 inches being reached in the extreme northern part of the basin. The mean annual precipitation over the whole basin above Gardiner is about 39 to 40 inches.

Monthly and annual precipitation in Kennebec basin.

CHESUNCOOK.[a]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1904	1.78	0.80	2.11	2.52	3.49	2.75	4.23	5.44	5.44	1.70	0.91	0.59	31.76
1905	2.67	.69	1.32	.71	2.42	1.65	1.52	.92	1.18	.77	3.15	2.22	19.22
1906	1.94	1.61	4.22	2.33	2.74	3.10	.....	.....	.....	.....	.....	.....	.....

[a] In basin of Penobscot River.

Monthly and annual precipitation in Kennebec basin—Continued.

FAIRFIELD.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1891	6.12	2.23	4.75	1.97	2.26	2.03	4.63	4.00	2.06	1.38	2.14	4.70
1892	3.38	2.28	1.82	.80	2.67	5.70	1.78	5.58	3.23	1.37	3.17	1.10
1893	1.62	2.77	2.49	2.13	3.42	.99	2.27	2.90	2.12	4.89	.85	2.50
1894	2.43	1.03	.86	.72	3.78	2.97	2.56	3.50	3.82	2.41	2.02	1.82
1895	2.23	.34	1.58	3.50	1.83	1.96	3.08	2.59	1.11	1.58	5.47	3.77
1896	.31	2.95	5.62	1.28	2.33	1.91	3.21	3.83	5.10	2.00	2.35	1.17
1897	3.31	1.00	2.63	2.40	4.47	3.39	3.52	2.82	2.54	.53	3.98	5.06
1898	5.07	6.48	1.45	2.31	1.55	3.32	1.13	3.71	2.37	4.33	3.71	1.42
1899	2.76	2.73	3.66	1.05	2.05	1.39	5.13	.46	3.58	1.11	2.32	1.93
1900	5.89	7.00	4.75	1.63	5.18	4.08	3.40	1.76	2.55	4.05	4.35	2.19
1901	2.74	1.95	5.22	3.96	2.35	1.64	2.99	3.39	3.79	2.77	2.19	7.98
1902	2.25	1.54	7.76	2.41	2.54	4.04	2.22	4.06	1.86	4.01	1.03	4.68
1903	3.94	3.39	6.35	1.95	.37	3.56	a4.53	a3.37	a1.01	a3.31	1.06	2.70
1904	3.21	1.65	3.78	5.75	4.75	2.32	2.69	4.39	5.58	2.05	1.01	1.44
1905	3.78	.99	.88	2.15	2.22	3.49	3.65	1.43	2.45	.38	3.80	3.19
1906	2.59	2.52	a3.33	3.09	3.55	3.29						
Mean, 1891–1905	3.27	2.55	3.57	2.27	2.78	2.86	3.12	3.19	2.87	2.41	2.68	2.89

FARMINGTON.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1891	6.54	2.13	8.28	1.97	1.94	3.93	3.42	4.03	1.45	1.68	2.69	5.64
1892	5.45	2.33	2.33	.85	3.75	6.26	3.29	5.09	4.16	1.49	4.44	1.39
1893	2.06	3.81	2.69	2.34	6.95	2.78	1.60	3.76	3.02	5.72	2.99	3.89
1894	1.64	2.22	2.20	1.43	5.14	3.20	1.92	2.61	5.73	5.02	2.97	2.79
1895	4.05	.95	1.88	5.67	3.06	3.38	1.05	5.93	1.92	1.99	5.76	6.25
1896	.80	5.58	10.83	2.66	b2.80	2.49	3.75	3.97	4.62	3.88	4.22	1.15
1897	5.45	b2.13	4.85	3.19	3.75	4.32	8.11	3.93	2.98	.95	5.01	4.98
1898	b5.54	6.85	.55	2.71	1.79	4.34	2.80	3.27	2.82	4.63	4.40	1.44
1899	2.57	2.60	5.79	.92	1.07	2.41	5.07	1.91	3.26	1.43	2.10	2.71
1900	6.19	10.76	7.04	1.74	5.12	5.51	4.88	2.30	4.82	4.23	8.50	1.77
1901	3.27	1.04	4.54	6.88	3.95	3.47	4.22	3.45	2.25	3.03	2.10	8.97
1902	3.06	2.32	8.43	3.67	5.16	5.28	1.93	3.34	3.60	4.68	1.19	4.53
1903	3.61	2.81	5.67	2.47	.59	5.70	4.27	2.67	1.17	3.08	1.24	4.19
1904	3.52	.72	3.13	6.36	5.72	1.03	4.97	4.58	4.44	2.09	1.83	1.76
1905	3.79	.70	1.41	2.12	2.65	3.60	4.07	3.10	5.27	1.24	2.58	2.69
1906	2.29	1.89	4.30	2.06	3.67	5.41						
Mean, 1891–1905	3.86	3.13	4.64	3.00	3.62	3.85	3.69	3.60	3.43	3.01	3.50	3.58

FLAGSTAFF.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1895								3.54	1.49	1.06	4.18	3.62
1896	1.20	3.92	6.97	1.45	2.75	2.40	4.85	3.14	4.53	3.44	2.80	1.05
1897	2.90	2.60	3.07	3.02	7.33	4.27	7.77	5.01	3.72	.72	a4.96	2.53
1898	4.80	6.90	a1.05	1.70	1.20	2.45	1.05	3.60	3.21	2.65	3.25	1.05
1899	1.85	3.83	4.05	.67	1.95	1.19	a6.81	.33	1.73	1.65	2.35	2.15
1900	4.30	5.40	3.90	.35	3.55	3.43	4.80	2.17	2.35	2.47	5.66	2.45
1901	2.20	1.50	2.75	7.83	2.34	4.58	5.01	4.95	1.65	2.40	2.20	4.88
Mean, 1895–1901	2.88	4.02	3.63	2.51	3.19	3.05	5.05	3.20	2.86	2.22	3.52	2.35

GARDINER.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1839	2.45	2.10	2.66	3.87	5.04	4.45	5.26	5.21	2.27	0.41	4.22	3.10
1840	1.77	2.29	4.14	4.14	4.22	4.20	1.72	3.72	1.54	6.02	3.88	3.52
1841	5.72	1.12	3.24	5.29	3.58	3.17	1.58	1.08	3.83	1.46	3.37	5.09
1842	2.88	4.19	3.26	2.51	1.83	3.05	3.08	2.35	3.06	1.61	3.33	5.67
1843	2.54	5.67	5.50	5.52	3.50	3.96	1.76	4.80	1.17	5.28	3.58	2.71
1844	3.95	1.68	4.82	.65	3.01	1.79	1.47	3.03	2.36	5.72	3.93	5.91
1845	5.85	2.25	2.96	2.59	2.68	1.95	6.55	2.40	3.20	2.89	10.56	4.82
1846	2.60	1.29	6.27	1.59	4.83	2.77	2.62	3.83	1.00	2.09	3.42	2.26
1847	5.11	3.67	1.62	2.90	2.69	6.32	3.34	3.95	3.32	4.06	3.64	4.28
1848	3.84	2.53	2.84	1.22	8.64	1.88	6.29	4.32	5.76	4.59	2.38	4.56
Mean, 1839–1848	3.68	2.71	3.73	3.03	4.00	3.35	3.37	3.47	2.75	3.41	4.23	4.20

a No record; figures supplied from Winslow record.
b No record; figures supplied from Gardiner record.

Monthly and annual precipitation in Kennebec basin—Continued.

GARDINER—Continued.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
.....	0.92	1.50	2.80	3.47	5.18	2.59	1.69	6.11	2.81	5.85	2.67	3.97	39.56
.....	3.09	2.96	2.29	2.98	11.76	5.44	3.04	4.31	3.70	5.29	2.41	4.10	51.37
.....	4.66	4.45	1.88	3.74	3.16	3.42	5.56	2.36	2.76	8.43	6.30	4.05	50.77
.....	2.36	3.89	2.22	6.13	.36	3.89	2.80	5.87	3.51	4.38	6.33	4.92	46.66
.....	1.49	9.47	1.94	1.14	7.16	.95	4.10	3.34	5.17	4.45	6.47	4.46	50.14
.....	2.78	4.35	4.73	5.62	5.28	5.05	4.95	1.41	5.03	3.25	8.12	3.16	53.73
.....	7.17	1.80	1.10	4.57	1.93	5.98	2.42	3.09	1.76	13.15	3.18	5.01	51.16
.....	2.25	1.95	.90	2.46	4.52	2.06	2.49	7.49	3.82	3.20	2.14	4.70	37.98
.....	4.22	2.46	4.03	5.30	4.74	3.59	2.33	5.51	1.24	4.97	3.63	4.19	46.22
.....	3.11	2.33	3.16	4.44	3.02	2.51	6.43	7.26	3.74	5.06	2.91	2.87	46.84
1, 1849–1858.	3.20	3.52	2.50	3.98	4.71	3.55	3.58	4.68	3.35	5.80	4.42	4.14	47.43
.....	4.42	2.15	10.06	2.51	3.00	6.35	1.77	2.79	2.48	1.08	4.75	6.54	47.90
.....	1.04	3.30	2.14	1.32	.87	2.36	1.97	4.70	3.63	3.81	5.36	3.26	33.76
.....	2.94	3.26	5.47	4.35	4.40	1.27	4.14	1.37	1.85	5.47	3.16	2.17	39.85
.....	4.20	3.60	3.49	2.75	1.92	3.81	2.41	1.94	3.18	5.21	4.33	2.56	39.40
.....	4.42	3.75	4.23	3.98	2.56	1.73	6.46	4.39	4.34	4.74	7.30	4.35	52.26
.....	3.51	2.07	4.58	2.46	3.94	.90	.59	6.12	4.32	2.76	5.77	4.03	41.05
.....	3.10	2.85	5.39	4.43	5.05	2.68	4.61	1.46	.84	4.75	3.24	3.23	41.63
.....	1.63	5.24	5.47	1.91	4.97	3.50	3.01	5.50	5.66	2.59	3.18	3.00	45.66
.....	2.62	4.36	5.76	4.96	5.27	1.96	3.94	8.49	.98	4.60	2.85	1.89	47.68
.....	2.86	1.87	2.38	2.28	9.59	3.20	1.87	1.06	8.24	.98	6.76	2.04	43.13
1, 1859–1868.	3.07	3.24	4.90	3.10	4.16	2.78	3.08	3.78	3.55	3.60	4.67	3.31	43.24
.....	1.96	6.75	4.00	3.05	4.50	5.50	1.51	1.17	3.37	12.67	3.10	4.74	52.32
.....	6.12	5.93	3.22	4.78	1.90	1.94	2.43	1.99	1.33	6.39	4.19	2.82	43.04
.....	2.11	1.56	5.37	3.38	3.92	1.58	4.58	4.93	1.84	7.58	4.90	3.28	45.03
.....	1.86	1.84	3.03	1.85	2.58	3.88	3.10	6.98	4.73	3.42	5.82	3.57	42.64
.....	4.63	2.09	3.94	2.97	2.38	1.26	3.56	1.59	3.88	6.01	3.63	2.03	37.97
.....	4.39	3.33	1.96	4.63	3.14	3.86	5.57	6.21	2.76	1.72	2.99	1.54	42.10
.....	2.94	3.72	3.70	3.92	2.90	5.87	2.22	6.66	4.89	5.06	3.67	.83	46.35
.....	3.03	5.88	7.96	2.69	3.62	2.95	6.16	.20	4.63	2.59	4.13	3.45	47.29
.....	1.69	.55	7.91	3.01	1.61	1.16	2.22	5.28	1.42	5.27	8.24	1.24	39.60
.....	3.57	2.73	3.13	5.84	1.49	3.69	1.08	4.43	2.39	7.82	4.60	7.55	48.32
1, 1869–1878.	3.23	3.44	4.42	3.61	2.80	3.17	3.24	3.94	3.12	5.85	4.53	3.10	44.45
.....	2.88	3.08	4.21	3.39	1.50	5.83	5.27	5.21	4.05	2.05	4.70	4.19	46.37
.....	4.10	3.61	2.68	3.29	2.39	1.53	3.94	2.18	4.06	4.39	4.86	2.96	39.99
.....	3.73	5.84	5.31	1.56	5.89	3.09	3.76	2.36	3.00	2.65	3.26	6.56	47.02
.....	3.56	4.96	5.04	2.65	4.74	4.25	2.60	.34	7.00	2.02	1.14	3.53	41.83
.....	2.50	2.89	2.24	3.46	5.02	4.86	3.49	.32	3.11	4.48	2.84	3.67	38.88
.....	5.40	7.29	5.40	6.53	4.00	1.22	3.17	4.22	2.11	3.14	3.29	5.05	52.82
.....	5.26	6.44	2.18	2.50	3.41	6.50	1.73	3.21	1.98	3.94	2.86	2.60	42.61
.....	6.61	7.25	3.90	1.43	3.76	1.85	1.93	2.82	3.68	3.67	6.06	4.68	47.64
.....	7.32	5.62	7.27	6.81	1.08	3.42	6.96	3.42	1.05	2.44	3.64	5.61	54.65
.....	5.13	5.90	5.09	2.27	2.48	2.59	2.20	4.33	7.12	6.71	5.98	4.20	54.00
1879–1888.	4.65	5.29	4.33	3.39	3.43	3.51	3.70	2.84	3.72	3.55	3.86	4.30	46.57
1839–1888.	3.57	3.64	3.98	3.42	3.82	3.27	3.39	3.74	3.30	4.44	4.34	3.82	44.73
.....	5.20	1.84	2.76	2.38	2.54	4.18	2.96	1.60	2.56	4.59	5.44	5.51	41.56
.....	3.18	3.78	4.52	1.51	7.84	3.61	[a]	.....	.....	.....	.....	[b]	.....
.....	2.70	4.79	3.18	2.52	4.66	2.56	1.12	3.27	3.23	5.90	1.83	5.13	40.89
.....	3.30	1.99	1.44	1.86	5.84	1.18	2.30	3.08	3.81	4.25	2.21	2.80	34.06
.....	2.50	1.64	2.48	4.83	1.50	2.01	4.55	3.28	1.21	1.82	6.85	4.40	37.07
.....	.87	5.25	7.19	2.02	2.80	1.94	3.18	2.88	7.60	2.64	4.12	1.52	42.01
.....	4.51	2.13	4.30	2.86	5.94	4.32	3.15	2.66	3.11	.92	5.99	3.83	43.72
.....	5.54	5.45	1.76	3.44	1.60	3.56	.98	3.73	2.90	6.23	4.57	2.74	42.50
.....	3.41	3.10	5.56	1.19	1.87	2.43	5.48	1.08	3.90	1.85	2.42	2.61	34.90
.....	7.19	8.96	7.23	2.50	5.42	1.34	1.87	2.77	2.45	4.47	5.28	1.64	51.12
.....	3.78	1.76	6.25	6.43	3.97	1.36	4.26	5.54	2.08	4.18	2.41	9.43	51.45
.....	2.67	1.70	10.33	3.71	2.01	4.52	2.07	4.46	3.22	4.90	1.21	5.35	46.15
.....	4.54	3.63	6.65	1.42	.45	5.12	4.77	2.90	1.34	3.82	1.63	3.56	39.83
.....	4.12	2.24	3.71	7.10	3.95	1.29	1.25	4.53	5.09	2.02	2.39	2.28	39.97
.....	4.85	1.32	.94	2.10	2.17	4.83	4.52	2.03	4.09	.78	3.95	3.12	34.70
.....	2.95	1.98	4.80	3.74	4.52	4.89	.....	.....	.....	.....	.....	.....	.....
, 1893–1905	3.84	3.38	4.09	3.23	3.24	2.80	3.04	3.25	3.39	3.37	3.45	3.72	41.40
1839–1903[b]	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	44.41

[a] No record at Gardiner from July, 1890, to December, 1892, inclusive.
[b] Missing records, 1890–1892, supplied from Lewiston records.

Monthly and annual precipitation in Kennebec basin—Continued.

GRANT FARM.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904		0.38	1.70	1.30	4.01	2.91	3.96	2.55	7.85	2.72	1.31	.....
1905	.....	.....	.....	.....	4.05	2.86	2.70	.79	1.15	.48	1.62	.....

GREENVILLE.

1904	.....	.....	.....	.....	5.27	3.00	6.85	4.09	7.63	2.44	0.47	.....
1905	.....	.....	.....	1.91	3.22	3.99	2.52	1.43	2.82	.86	2.51	1.22
1906	1.20	1.23	.....	2.20	4.72	3.43	6.28	.....	.....	.....	.....	.....

JACKMAN.

1894	2.25	1.48	1.79	.....	.....	.....	.....	.....	.....	.....	.....	.....
1897	.....	2.20	2.55	0.95	5.00	4.00	6.23	2.45	4.20	1.68	.....	.....
1903	2.32	4.65	3.30	1.51	.....	.....	.....	.....	.....	.....	.....	.....
1904	.....	.....	.....	1.91	.....	.....	.....	.....	.....	.....	1.52	1.82
1905	2.42	.94	1.28	.84	.....	.....	.....	.....	.....	.....	1.91	2.10
1906	1.57	1.57	3.15	1.85	4.33	3.72	.....	.....	.....	.....	.....	.....

KENTS HILL.

1891	6.28	3.41	5.37	1.85	1.98	3.05	4.50	4.00	1.50	2.12	1.79	5.57
1892	4.88	1.60	1.79	1.05	2.79	5.75	2.48	6.30	4.98	1.25	3.98	1.37
1893	2.41	4.53	2.95	2.85	6.76	.....	.....	.....	.....	.....	.....	.....
1894	.....	1.32	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

KINEO.

1895	2.11	1.35	1.22	2.03	2.58	3.26	4.07	4.90	1.45	0.87	5.47	2.99
1896	.37	2.51	4.19	2.24	2.46	2.47	4.02	2.00	3.27	3.61	1.95	.90
1897	2.82	1.95	2.43	3.27	3.96	2.59	8.37	3.11	2.62	1.52	2.69	2.25
1898	1.24	6.90	.82	2.22	.....	.....	.90	3.30	4.50	.....	.....	.....
1899	.....	3.50	.....	.....	3.20	3.94	7.37	.....	.....	.....	.....	.....
1900	5.17	3.47	3.90	.....	3.49	3.24	5.21	1.51	2.55	.....	.....	.....
1901	2.65	1.80	1.45	4.85	.75	6.55	1.95	2.55	.94	2.26	2.70	7.40
1902	2.15	3.60	4.73	2.65	4.67	6.15	4.03	3.01	5.46	[a]3.40	.81	2.01
1903	2.36	.....	4.99	.....	2.79	.....	.....	.....	.....	.....	.....	2.01
1904	.....	.....	.....	1.54	2.71	.....	.....	.....	.....	.....	.....	.....
Mean, 1895–1897, 1901–1902	2.02	2.24	2.86	3.01	2.88	4.20	4.49	3.11	2.75	2.33	2.72	3.11

MADISON.

1894	3.23	2.25	1.70	1.45	4.75	6.00	2.12	3.28	4.81	5.30	.....	.....
1902	3.91	3.88	11.04	3.62	5.49	7.45	2.29	5.93	3.70	6.61	1.42	4.63
1903	4.31	3.98	6.32	1.94	.23	3.72	5.37	2.30	.76	2.40	1.17	1.43
1904	2.28	1.71	2.79	7.63	6.63	3.36	6.10	7.38	6.34	2.98	1.23	1.55
1905	4.08	1.61	2.13	2.59	3.73	4.65	5.75	2.23	5.61	1.13	4.60	3.45
1906	4.04	2.99	4.83	4.27	5.12	5.72	.....	.....	.....	.....	.....	.....
Mean, 1902–1905	3.65	2.80	5.57	3.94	4.02	4.80	4.88	4.46	4.10	3.28	2.10	2.76

[a] No record; figures supplied from The Forks record.

Monthly and annual precipitation in Kennebec basin—Continued.

MAYFIELD.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1891	.....	.....	.....	3.75	2.37	3.34	5.11	4.78	1.58	1.56	2.91	.....	.....
1892	.....	.....	.....	.....	.....	8.36	2.73	9.19	5.63	1.60	5.14	.....	.....
1893	.....	.....	.....	1.86	5.65	2.69	3.27	5.20	4.21	7.37	3.49	.....	.....
1894	.....	.....	.....	1.17	4.83	6.45	2.65	2.05	5.71	6.41	2.48	.....	.....
1895	.....	.....	.....	6.21	3.83	3.03	4.44	3.86	2.09	2.25	7.63	5.84	.....
1896	0.94	.....	.....	2.34	3.02	3.13	6.07	4.90	5.31	4.77	5.11	1.24	.....
1897	.....	.....	.....	4.56	5.04	3.41	8.04	4.07	3.01	1.43	5.12	3.43	.....
1898	.....	.....	.....	2.26	1.88	2.94	1.52	4.43	3.57	5.79	6.02	1.14	.....
1899	2.50	4.00	4.87	.99	3.02	2.04	4.79	1.05	3.33	1.71	2.19	3.05	33.54
1900	6.27	7.39	5.65	1.57	5.84	3.31	4.48	1.25	3.26	2.99	7.43	1.10	50.54
1901	2.60	1.20	5.55	6.33	2.26	2.94	5.40	5.25	2.63	3.43	2.24	8.63	48.46
1902	3.21	3.60	9.50	4.16	3.40	7.39	2.95	6.36	4.33	5.83	1.65	4.12	56.50
1903	5.48	3.27	5.33	1.56	.58	6.54	5.27	3.03	.85	3.12	1.61	3.06	39.70
1904	3.07	1.81	2.76	3.42	6.86	3.17	4.41	5.32	5.73	2.42	1.58	1.47	42.02
1905	4.25	[a]1.11	1.00	2.17	3.29	3.39	4.39	1.86	4.40	.90	2.87	2.69	32.32
1906	2.69	2.01	5.24	2.70	3.90	4.61	.....	.....	.....	.....	.....	.....	.....
Mean, 1899–1905.	3.91	3.20	4.95	2.89	3.61	4.11	4.53	3.45	3.50	2.91	2.80	3.45	43.31

ROACH RIVER.

1901	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.95	6.[a]5	.....
1902	3.25	3.82	3.37	1.21	3.56	9.29	4.30	5.32	.....	3.21	1.16	2.70	.....
1903	2.05	4.90	5.76	2.23	.....	.....	.....	.....	.....	.....	.....	.....	.....

SOLON.

1902	.....	.....	.....	3.20	4.62	.....	2.92	3.43	5.39	3.43	2.30	3.10	.....
1903	3.78	2.81	4.90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

THE FORKS.

1901	.....	.....	.....	.....	.....	.....	.....	.....	.....	3.31	2.60	8.80	.....
1902	3.50	3.35	5.60	3.20	4.62	6.42	2.92	3.43	5.39	3.40	2.30	3.10	47.32
1903	2.30	3.63	4.42	1.35	.61	4.36	4.58	3.24	.91	1.60	1.73	2.97	31.70
1904	2.95	1.40	1.95	3.70	5.08	4.64	7.53	2.69	6.82	2.23	1.34	1.58	41.91
1905	3.39	1.11	1.30	1.68	3.58	4.33	3.37	1.86	3.47	1.24	2.90	2.40	30.63
1906	2.24	2.05	4.20	2.18	3.13	3.07	.....	.....	.....	.....	.....	.....	.....
Mean, 1902–1905.	3.04	2.37	3.34	2.48	3.47	4.04	4.60	2.81	4.15	2.12	2.07	2.51	37.90

WINSLOW.

1895	.....	.....	.....	.....	.....	.....	.....	.....	1.56	2.04	6.52	.....	.....
1896	0.40	3.40	6.24	1.74	2.52	2.33	3.46	3.59	5.86	2.66	2.89	1.29	36.38
1897	[b]4.51	1.39	3.06	2.44	5.30	3.34	5.50	3.42	3.02	.68	4.96	2.71	40.33
1898	4.67	4.91	1.05	2.44	1.51	3.42	1.95	3.09	2.77	5.38	3.86	1.59	36.64
1899	2.88	2.45	4.10	1.00	2.32	1.13	6.81	.25	4.03	1.34	1.76	1.90	29.97
1900	6.35	6.27	5.21	1.95	6.32	4.09	4.17	2.55	3.26	4.86	5.00	[b]1.64	51.67
1901	2.91	.65	5.15	4.50	[b]3.97	2.51	3.31	4.54	3.92	3.28	1.38	8.23	44.35
1902	2.31	1.49	8.90	2.51	2.24	4.61	2.62	[b]4.46	2.29	5.54	1.17	4.25	42.39
1903	4.14	3.01	7.15	2.21	.31	4.47	4.53	3.37	1.01	3.31	1.34	2.98	37.83
1904	2.58	1.51	3.41	5.38	4.91	1.47	2.52	4.94	5.84	2.64	1.62	1.65	38.47
1905	3.66	.93	.83	2.20	2.53	3.39	4.26	2.03	3.20	.62	4.00	2.82	30.47
1906	2.78	1.33	3.33	2.78	1.64	3.28	.....	.....	.....	.....	.....	.....	.....
Mean, 1896–1905.	3.44	2.60	4.51	2.64	3.19	3.08	3.91	3.22	3.54	3.03	2.80	2.91	38.87

[a] No record; figures supplied from The Forks record.
[b] No record; figures supplied from Gardiner record.

The table of average precipitation and fig. 3 have been prepared from the foregoing data, for the purpose of computing the ratio of run-off to rainfall at Waterville. They represent fairly well the average precipitation on the basin above Waterville after and including 1895. Probably the figures for the years previous to 1895 are

slightly too great, as in those years no stations were maintained northern part of the basin, where the precipitation is consid less than it is farther south. The values given in the table are on the following records: Fairfield, 1891–1906; Farmington, 1891- Kineo, 1895–1898, 1900–1902; Madison, 1894, 1902–1906; Ma 1891–1906; The Forks, 1903–1906.

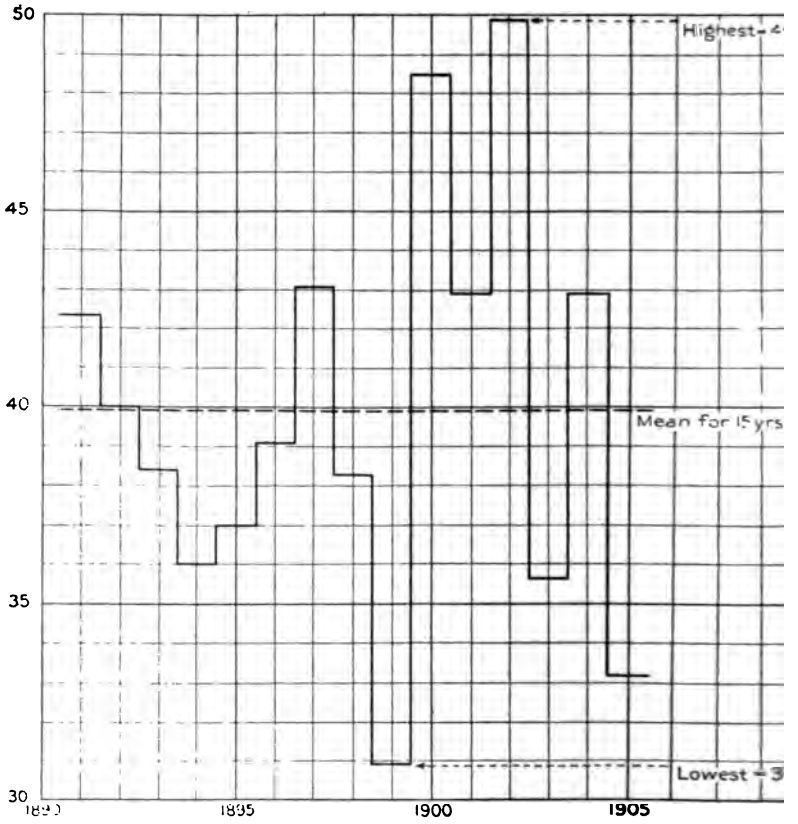


FIG. 3.- Mean annual precipitation on Kennebec basin above Waterville, Me., 1891-19

Average precipitation in Kennebec drainage basin above Waterville, 1891–19

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1891	6.3	2.1	6.5	2.6	2.2	3.1	4.4	4.3	1.7	1.5	2.6	5.1
1892	1.4	2.3	2.1	0.8	3.2	6.8	2.6	6.6	4.3	1.5	4.2	1.2
1893	2.1	3.7	2.6	2.1	5.3	2.2	2.4	4.0	3.1	6.0	2.4	2.9
1894	2.4	1.8	1.6	1.2	4.6	4.6	2.3	2.9	5.0	4.8	2.5	2.3
1895	2.8	.9	1.6	4.4	2.8	2.9	3.2	4.3	1.6	1.7	6.1	4.7
1896	.7	3.7	7.0	2.0	2.7	2.5	4.4	3.6	4.6	3.5	3.3	1.1
1897	3.6	1.9	3.2	3.3	1.9	3.6	7.2	3.8	3.0	1.0	4.4	3.2
1898	4.9	6.8	1.9	2.2	1.6	3.3	1.5	3.7	3.3	4.4	4.3	1.3
1899	2.4	3.3	1.6	.9	2.2	1.8	5.4	.9	3.0	1.5	2.4	2.5
1900	5.6	6.8	5.0	1.3	4.6	3.9	4.6	1.8	3.1	3.4	6.5	1.9
1901	2.7	1.5	3.9	6.0	2.3	3.8	3.9	3.9	2.2	2.8	2.3	7.6
1902	2.9	3.0	8.3	4.3	4.3	6.1	2.7	4.5	3.8	4.9	1.2	4.0
1903	3.9	3.4	5.5	1.9	.5	4.8	4.8	2.9	.9	2.7	1.4	2.9
1904	3.0	1.5	2.9	5.4	5.8	2.9	5.1	4.9	5.8	2.4	1.5	1.6
1905	3.9	1.1	1.3	2.1	3.1	3.9	4.2	2.1	4.2	1.0	3.4	2.9
1906	2.8	2.3	4.6	2.9	3.9	4.4						
Mean, 1891-1905												

SNOW STORAGE AND WATER EQUIVALENT.

The measurement of snowfall by catching it in the ordinary rain gage, as rain is caught in the summer season, is liable to considerable error, owing to the deflection of air currents by the gage. The snowflakes being light, tend to be carried over or diverted from the mouth of the gage, especially when considerable wind is blowing. It is therefore desirable to supplement winter precipitation records, obtained by the use of the rain gage with measurements of the actual depth of snow upon the ground from time to time, taken at some level place where an average depth prevails, and with determinations of the water equivalent of the snow, obtained by melting a prism of it. Records of this nature have been kept since the winter of 1903–4 at several of the precipitation stations in the Kennebec basin, and the data thus obtained are presented in the following table:

Water equivalent of snow in Kennebec basin.

Station.	Date.	Depth of snow.	Water equivalent.	Ratio: Water to Snow
		Inches.	*Inches.*	
Grant farm	February 11, 1904	20	5.92	0.296
Do	April 21, 1904	.....	5.88	.....
Do	December 31, 1904	15	1.55	.103
Do	March 1, 1905	33	7.78	.236
Do	December 31, 1905	11	2.4	.218
Do	January 28, 1906	40	8.25	.206
Chesuncook	February 7, 1904	27	4.03	.149
Do	March 11, 1904	12	1.20	.100
Do	do	14	1.32	.094
Do	do	16.5	1.44	.087
Do	February 22, 1905	25	4.3	.172
Do	March 27, 1905	10	4.0	.400
Do	November 12, 1905	12	1.56	.130
Do	January 1, 1906	15	2.75	.183
Do	February 1, 1906	10.33	4.10	.397
Do	February 16, 1906	17	2.97	.175
Do	March 15, 1906	22	5.96	.271
Greenville	December 16, 1905	12	1.89	.158
Do	December 30, 1905	10	1.85	.185
Do	January 17, 1906	12	2.5	.208
Do	February 17, 1906	11	2.05	.186
Do	March 6, 1906	9	2.22	.247
Do	March 19, 1906	13	3.58	.275
Do	March 28, 1906	48	11.85	.247
Jackman	February 2, 1904	28	6.20	.221
Do	January —, 1905	23	3.2	.139
Do	March 22, 1905	23	5.2	.226
The Forks	February 4, 1904	20	4.16	.208
Do	February 29, 1904	18	4.33	.240
Do	March 8, 1904	24	6.29	.258
Do	do	18	5.30	.294
Do	April 20, 1904	9	3.54	.395
Do	January 17, 1905	27	5.4	.200
Do	February 1, 1905	27	5.3	.196
Do	February 15, 1905	35	7.0	.200
Do	March 2, 1905	28	5.5	.196
Do	March 16, 1905	23	5.4	.234
Do	December 15, 1905	12	1.5	.125
Do	January 15, 1906	[a] 14	3.6	.257
Do	February 17, 1906	22	5	.227
Do	March 15, 1906	34	6.5	.191
Do	April 15, 1906	16	5.6	.350
Madison	March 19, 1903	10	4.60	.460
Do	February 26, 1904	32	4.83	.151
Do	February 3, 1905	26	5.46	.210
Winslow	January 15, 1905	17	4.27	.251
Do	March 1, 1905	32	8	.250
Do	March 15, 1905	27	7.5	.278

[a] Heavy; one-half inch ice on ground.

Fig. 4 shows graphically the water equivalent of snow on the at The Forks, determined at different times during the las seasons. A comparison of all the stations in the previous tab cates that The Forks is fairly representative of the whole Ke basin, as regards depth of snow and its water equivalent, so th diagram may be said to show approximately the snow sto water in the basin during the last three winters.

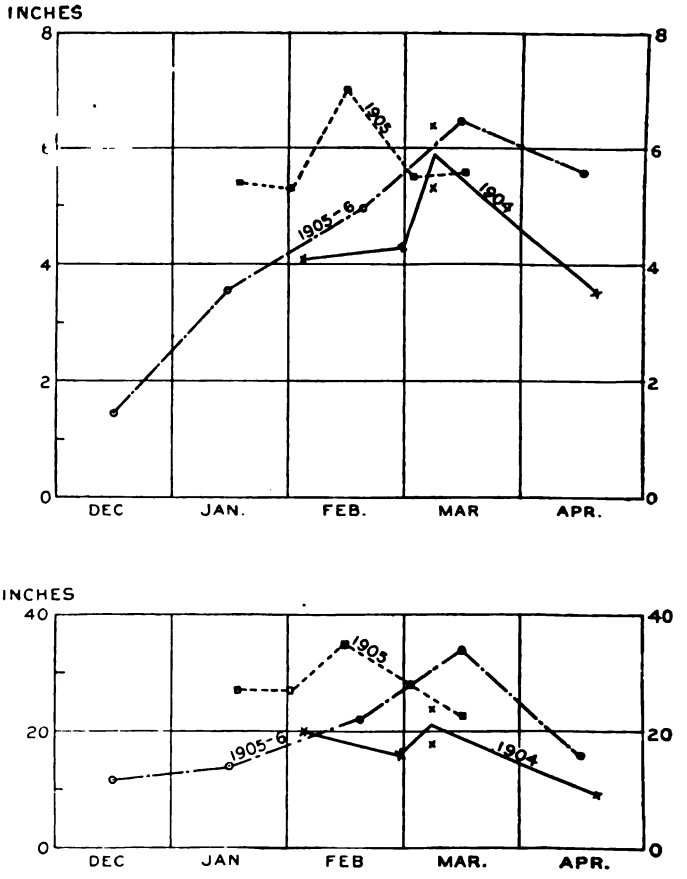


FIG. 4.—Water equivalent of snow on the ground at The Forks, Me.

STREAM FLOW.

SOURCES OF INFORMATION.

The water flowing in surface streams forms one of the most va natural assets of any country and is an important factor in the opment of its commercial and agricultural resources. Data in to the regimen and total flow of streams and of the conditions affect this flow are of primary importance to their economic us

Users of surface waters have for a long time recognized the value of data in regard to flow, and have collected much information relative to the streams in which they are interested. The general demand for information on this subject led to the organization of the hydrographic work of the United States Geological Survey, and as a result records of discharge for the more important streams in the United States are now generally available.

In the Kennebec basin the water users have been active for many years in keeping records of gage height and discharge; in fact, it was chiefly owing to the interest shown here and the urgent requests from this part of the State for more extended information that hydrographic work was begun by the United States Geological Survey in Maine in 1901. Since that time systematic measurements of flow have been carried on by the Survey, not only in the Kennebec basin but on most of the important rivers of the State. The combined records from these two sources furnish a most valuable collection of facts relative to the water resources of this area. The following pages contain a compilation of these data, which have been carefully revised and adjusted in accordance with the best information available to date.

FIELD METHODS.

Data collected by private parties have generally been obtained at power plants where the discharge is divided, part going over a dam, part through the wheels, and part through by-channels. The flow over the dam is obtained from the measured head by the use of a weir formula, that through the wheels by the use of each wheel as a meter, and that through the by-channels by means of weirs or by current-meter measurements. The sum of these components is the total discharge of the river at the section. The general methods used at stations of this character are fully described in Water-Supply Paper No. 150[a] (Weir experiments, coefficients, and formulas, by R. E. Horton), and the use of turbines for measurement purposes is explained in detail in Water-Supply Paper No. 180 (Turbine water-wheel tests and power tables, by R. E. Horton).

The Geological Survey has generally collected its data at current-meter gaging stations located at points at which it is considered that the information will be of special value. At these stations observations of stage, or gage height, of discharge, and of general conditions form the base data for computing the daily and total flow of the stream. The methods used in selecting current-meter stations and in collecting data are fully described in Water-Supply Papers Nos. 94 and 95.. They may be briefly stated as follows:

[a] The first edition of the paper has been exhausted. The second edition, including revisions and some additional data, has been published as Water-Supply Paper No. 200.

The selection of a site for a gaging station depends prim
the facilities for making the measurements of discharge. a
stations have accordingly been classified as bridge, cable.
wading stations. Pl. II, A, shows a typical cable stati
length of time a station is maintained depends largely on t
of each locality and the facilities for making the measurem
the water is to be used for power, special effort is made t
information concerning the minimum flow; if water is to b
the maximum flow also receives special attention. In all se
the country permanent gaging stations are maintained fo
statistical purposes, to show the conditions existing throu
periods. They are also used as primary stations, and in co
with short series of measurements serve as a basis for estima
flow at other points in the drainage basin.

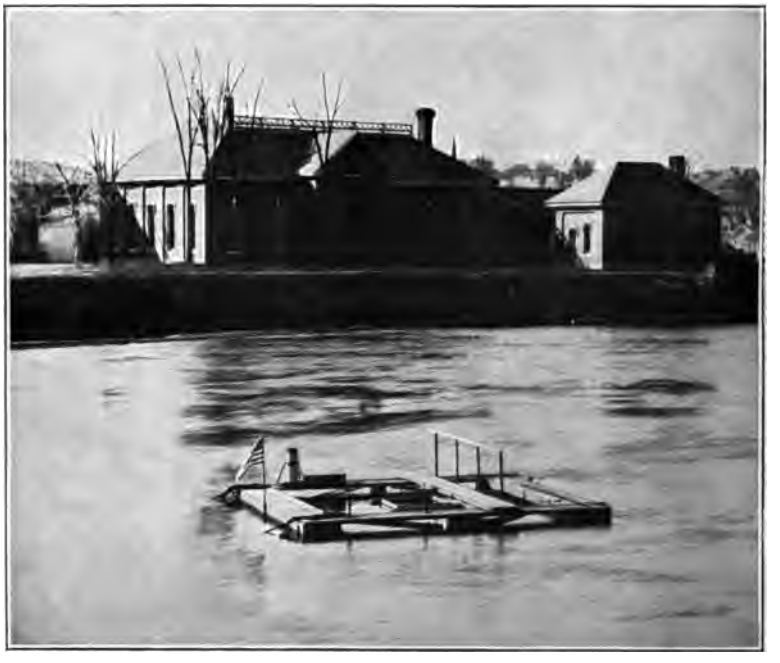
The gage heights are observed daily on the vertical staff
other type of gage, by some person living near by. The av
the gage readings, if more than one is taken in any day, is us
mean gage height for that day.

The measurements of discharge, which determine the qua
water flowing past the gaging station at a given stage and t
made by hydrographers of the Survey, who visit the stations
vals. This discharge is the product of the area, which is obta
soundings, and the velocity of the current, which is usually m
by some type of current meter.

The current meter is primarily an instrument for measu
velocity of moving water, and consists essentially of a wh
vanes, which may be shaped like those of a windmill or of a s
with cups like those of an anemometer, the necessary qual
being that moving water shall readily cause the wheel of the
turn. Each meter is rated before use. The rating is done by
the meter through still water at various observed speeds to de
the relation between the velocity with which the meter moves
the water and the revolutions of the wheel. This relation
been determined, the meter is used in running water, the rev
per unit of time noted, and the velocity of the water compute

In making the measurements an arbitrary number of po
laid off on a line perpendicular to the thread of the stream.
points the velocity and depth are observed. They are kn
measuring points, being usually fixed at regular intervals,
from 2 to 20 feet, depending on the size and conditions of the
Perpendiculars dropped from the measuring points divide the
section into strips. For each strip or pair of strips the mean v
area, and discharge are determined independently, so that co
in one part of the stream may not be extended to parts where
not apply.

A. CABLE STATION ON MOOSE RIVER AT ROCKWOOD, ME.



B. EVAPORATION AND RAINFALL STATION ON ANDROSCOGGIN RIVER AT LEWISTON, ME.

OFFICE METHODS.

For obtaining the daily discharge at current-meter gaging stations it is necessary that sufficient measurements be taken to cover the range of stage as indicated by the gage heights. With these and the other information in regard to the station, it is possible to construct a rating table which will give the discharge corresponding to any stage of the stream.

The construction of the rating table depends on the following laws of flow for open permanent channels: (1) The discharge will remain constant so long as the conditions at or near the gaging station remain constant; (2) the change of slope due to the rise and fall of the stream being neglected, the discharge will be the same whenever the stream is at a given stage; (3) the discharge is a function of the stage and increases gradually with it.

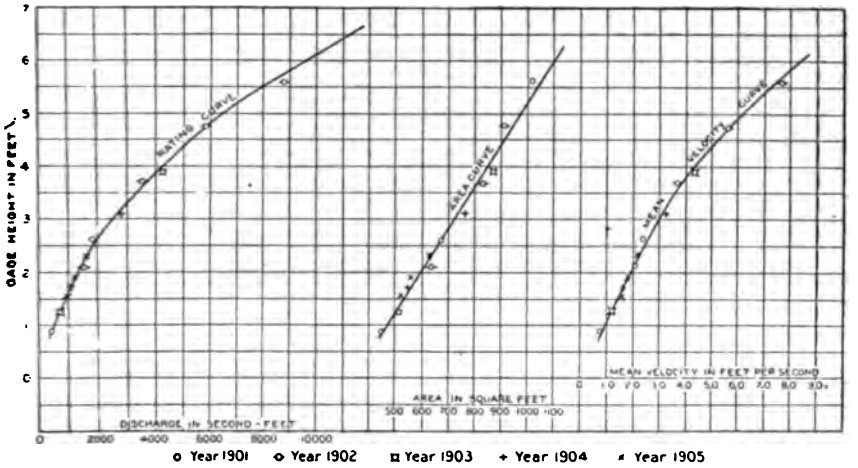


FIG. 5.—Rating, area, and mean velocity curves for Kennebec River at The Forks, Me.

The plotting of results of the various discharge measurements, gage heights being used as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. Fig. 5 shows a typical rating curve, that for the gaging station on Kennebec River at The Forks, with its corresponding mean velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is invariably either concave toward the horizontal axis or a straight line, unless the banks of the stream are overhanging.

The form of the mean velocity curve depends chiefly o slope, the roughness of the bed, and the cross section of Of these the slope is the principal factor. In accordar relative change of these factors the curve may be either a convex or concave toward either axis, or a combination From a careful study of the conditions at any gaging stat which the velocity curve will take can be predicted, an extended with reasonable certainty to stages beyond t actual measurements. Its principal use is in connection v curve in locating errors in discharge measurements and i ing the rating table.

The discharge curve is defined primarily by the meas discharge, which are studied and weighted in accordan local conditions existing at the time of each measuremen and beyond the measurements the curve may, howev located by means of curves of area and mean velocity. under normal conditions is concave toward the horizonta generally parabolic in form.

In the preparation of the rating table the discharge fo or half-tenth on the gage is taken from the curve. The between successive discharges are then taken and adjuste to the law that they shall be either constant or increasing

The determination of flow of an ice-covered stream is difficult and expensive than that for the open season, on frequent unstable conditions of ice cover and general lack tion in regard to the laws of flow of water under ice. This been taken up in a preliminary way in Water-Supply Pa (Determination of stream flow during the frozen season Barrows and R. E. Horton), which also contains a large data regarding the flow of Kennebec River at North Anson frozen season and a description of methods used.

DEFINITIONS.

The volume of water flowing in a stream—the "run-of charge" is expressed in various terms, each of which l associated with a certain class of work. These terms may into two groups: (1) Those which represent a rate of flow, feet, gallons per minute, miner's inch, and run-off in seco square mile, and (2) those which represent the actual water, as run-off in depth in inches and acre-feet. Those report may be defined as follows:

"Second-feet" is an abbreviation for cubic feet per sec the rate of discharge of water flowing in a stream 1 foot foot deep at a rate of 1 foot per second. It is generally fundamental unit from which others are computed.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly, both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

EXPLANATION OF TABLES.

As far as available the following data are given for each regular gaging station:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Tables of daily flow for stations located at dams.
6. Table of monthly and yearly discharges and run-off.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station; also, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, the gage height, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The rating table gives discharges in second-feet corresponding to each stage of the river as given by the gage heights.

The table of daily flow gives the mean discharge for the day.

In the table of monthly discharges the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. This is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the "Minimum" column the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. On this the computations for the remaining columns, which are defined above, are based.

ACCURACY OF DETERMINATIONS.

After the description of each gaging station a statement is made of the probable percentage of error in the figures for mean monthly flow. No refinement has been attempted in the determination of this percentage, which is only approximate, and which is based principally on the error of the discharge measurements with reference to the rating curve and the known conditions of flow in the vicinity of the gaging section. It is impossible to determine closely all errors caused by temporary or gradual changes in the conditions of flow, unreliability or ignorance of the observers, changes in channel length, or ice conditions.

Errors due to changes in conditions of flow are relatively small for large streams, except at very low stages. On small streams, however, a temporary obstruction at or below the gaging section, causing a change in area of cross section or in velocity of the current, may produce large errors in the computed daily discharge. As a rule, these changes do not occur frequently and are of a temporary character. For example, the lodging of logs on the controlling point below the gage reduces the velocity and hence the discharge for a given gage height. A few days later a sudden rise in the stream may clear the channel and restore normal flow. Unless the hydrographer has chanced to make a measurement of discharge during the period of abnormal conditions an error has been introduced into the computed daily and monthly flow. Owing to the limited appropriation for stream gaging and the large number and wide separation of the gaging stations, it is impossible for the hydrographers to make measurements frequently enough to eliminate all errors arising from these abnormal conditions. It has further been found impracticable, as a rule, so to instruct the observers that they will correctly report unusual conditions.

Gradual changes in the conditions which affect the flow can be estimated and corrected more readily than temporary changes. Here, again, the hydrographer is often handicapped by inability to make sufficient measurements to show properly the varying rate of change in channel conditions. In such cases the daily discharges are obtained either by an indirect method based on the assumption of a constant rate of change from day to day between measurements or by a series of rating curves.

Observers are, as a rule, conscientious in reading the gages, but with few exceptions they are wholly unfamiliar with engineering work of any description. The observers' records, however, are examined and checked by hydrographers and large errors are thus eliminated. The observers are usually instructed to read the gage to the nearest tenth or half tenth twice each day, and at times of floods several times a day. In high and medium stages the errors in reading

the gage are thus negligible, but in low stages, when a difference of one or two hundredths in the stage of the river or slight fluctuations during the day cause errors of several per cent, it is evident that the regular method of observation is inadequate. Hence monthly minimums may be considerably in error, but it is believed that in general the monthly means for months of low flow are good owing to the tendency of positive and negative errors to offset each other.

All gages maintained by the Survey are checked with a level at least once each season, and oftener where conditions are such that the gage tends to settle or change position. Gage readings are corrected, where necessary, on the basis of these levels, and it is believed that no errors of any consequence in gage heights have occurred from this source.

Beginning with the winter of 1903–4, facts regarding ice cover and extent of frozen conditions have been noted at several of the gaging stations by the observers. No attempt has been made to give winter records of flow, except for Kennebec River at North Anson. These are based on numerous current-meter measurements and are for the most part probably correct within 10 to 15 per cent. The Hollingsworth & Whitney records of flow at Waterville are probably not in serious error during the winter season, as at this time most of the water is used through the wheels, which are not affected by ice conditions.

The errors described in the foregoing paragraphs are not to be considered as applying to every station. They have been fully treated here in order to call to the attention of the reader the possible sources of error and the limitations of engineering work of this kind. Although the resulting probable error may seem large, it should be remembered that stream-gaging data and records of flow are used mainly as a basis for predicting the maximum, minimum, and mean discharge of a stream to be expected in future years. Since the mean annual flow of a stream may be several times larger one year than it is the next, it is seen that for records of short duration an estimate which involves an error even as great as 50 per cent is not without value. On the other hand, it is a waste of money and needless refinement—indeed, virtually impossible—to obtain values much closer than 3 per cent in ordinary current-meter work.

Special emphasis is laid on the fact that the value of stream-gaging data is determined mainly by the number of years during which the record has been maintained, and not so much by the degree of accuracy of the mean discharge for each year; that is, the longer the record the more nearly does it give the maximum, minimum, and mean flow which may be expected in the future.

Monthly means which are stated in the descriptions to be within 5 per cent of the true flow are considered to be very good, and those

within 10 per cent are considered close enough for all practical poses. Errors in monthly means which are greater than 15 per are due either to an insufficiency in the number of measuremen to poor natural conditions which could not be avoided, or to ch at the gaging station which could not be foreseen at the time establishment. It should further be noticed that the larger occur in daily discharges at the highest stages, which continu for a few days, and hence the effect on the accuracy of the m mean is not so great as might at first appear. Also by far the g number of gage heights are for medium stages, where the error rating curve is rarely as great as 10 per cent and is usually mu than 5 per cent. The errors of the daily discharges are often c able, owing to fluctuation of the river height. The maximum minimum flow for the month may also have an additional erro to the fact that they are based on the extreme low or high part rating curve, which is usually not so well defined as the interm portion. In the mean monthly flow, however, for which th mates of accuracy are made, the error is reduced to a very amount, owing to the compensation of variable negative and p errors.

USE OF DATA ON STREAM FLOW.

In the consideration of the development of enterprises which d largely on the use of water, it is essential to have detailed and ac information in regard to flow. This information should includ for the total flow of the year and its distribution by days, m and seasons.

The total flow is given in the table headed "Maximum, mini and mean discharge," which also gives the maximum and me the months stated, and shows in a general way the conditions tha be expected at the station.

The daily distribution and duration of flow may be found from the tables of daily discharge or by the use of gage heigh rating tables. For determining the duration, the discharges o heights should be tabulated according to their size, and under should be entered the number of days on which it occurs durin year. By adding these figures for successive years and averagin totals a result may be obtained showing the average number of during the year when the stage and discharge are above or be given amount. These values may also be plotted in a curve.

When estimates of flow are desired at points on a stream other those where continuous measurements have been made, great must be taken in applying these published data. Very frequen is found that different portions of the same drainage area will greatly in run-off and the general regimen of flow. Hence serious

may arise in applying these data on flow by simply comparing drainage areas at the two points, and such an application should never be made unless it is based also on a knowledge of the conditions affecting flow, the relative amount of lake or pond surface, the geologic, topographic, and forest conditions, etc. It is always best to make a few actual measurements of flow at the desired point and compare these with the flow at the same time at the regular station; or, better still, to erect a temporary gage and carry observations over several weeks or more. In this way the long-time records of the Survey can be used at various places along the river and made of general value.

LOCATION OF STATIONS.

The location of the various gaging stations for which data regarding flow are here given, is indicated on Pl. I, by letters, and in the following table:

Gaging stations in Kennebec basin.

Letter on Pl. I.	River.	Location.	Date established.	Established by—
A	Kennebec	The Forks	September 28, 1901	U. S. Geological Survey.
B	do	North Anson	October 18, 1901	do.
C	do	Waterville	January 12, 1893	Hollingsworth & Whitney Co.
D	Moose	Rockwood	September 7, 1902	U. S. Geological Survey.
E	Roach	Roach River	November 10, 1901	do.
F	Dead	The Forks	September 29, 1901	do.
G	Carrabassett	North Anson	October 19, 1901	do.
H	Sandy	Madison	March 23, 1904	do.
I	Messalonskee	Waterville	June 18, 1903	do.
J	Cobbosseecontee	Gardiner	June 16, 1890	Gardiner Water Power Co.

KENNEBEC RIVER AT THE FORKS.

This station was established September 28, 1901, by N. C. Grover, at the wooden highway bridge across Kennebec River at The Forks, about 2,000 feet above the mouth of Dead River. Of the drainage area at this station, 1,240 square miles are tributary to Moosehead Lake and the remaining 330 square miles drain into the Kennebec by small streams with steep slopes and no storage. Practically all land surfaces above this point are in forest.

The channel is straight for 200 feet above and 500 feet below the station, is unbroken by piers, and is about 125 feet wide at ordinary stages of the river. The current is swift at high and medium at low stages. The banks are high and rocky, and the bed is rocky and permanent.

Discharge measurements are made from the bridge. The initial point for soundings is on the left bank, marked by a rod across the bridge, just above the abutment and below the bridge floor.

From about May 1 to July 31 considerable fluctuations in gage height, ranging in amount from 2 to over 5 feet, occur daily, owing to the regulation of the flow at Indian Pond dam, for the purpose of log driving. The morning and evening records obtained by the observer represent the maximum and minimum heights of each day during this period, as well as can be determined. The mean daily discharge during this period for the years 1903 to 1905, as given on page 39, is computed by averaging the discharges as applied to the morning and evening gage heights, account being taken also of the relative length of the high and low water periods. From April 23 to August 9, 1906, four daily gage readings were made and used in computing the daily flow.

There are two gages—one, a vertical rod, is attached to the timber retaining wall on the left bank, about 75 feet above the bridge; the other is a standard chain gage attached to the bridge floor. The length of the chain is 17.08 feet. Gage-height observations are made twice each day by William W. Young. The datum of the two gages is the same and is referred to bench marks as follows: (1) The top of a bolt on the east abutment, on the north side of the bridge; elevation, 12.85 feet; (2) a marked point on the floor of the bridge near the east end of the gage box; elevation, 15.42 feet. Elevations are above gage datum, which is 565.44 feet above mean sea level, as determined by the Kennebec River survey of 1904 and readjusted in 1906.

All estimates previously published for years prior to 1905 have been revised on the basis of the 1905 rating curve.

Values for monthly means as given herewith are considered to be well within 5 per cent of the true flow. Daily discharges are subject to much larger errors, particularly above gage height 6.0 feet and during the log-driving season.

Discharge measurements of Kennebec River at The Forks.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
September 28	2.60	1,860	July 27	1.70	1,060
October 20	.90	473	August 29	3.12	2,720
1902.			1905.		
April 25	3.70	3,500	April 21	1.90	1,200
June 16	5.60	8,860	July 18	1.53	950
June 25	4.75	5,900	September 4	2.30	1,600
September 29	2.10	1,480	1906.		
1903.			September 5	2.70	2,200
August 18	3.95	4,180			
November 4	1.26	757			
Do	1.26	750			

Daily gage height, in feet, of Kennebec River at The Forks.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1901.[a]					1901.[a]				
		2.4	2.6		17		1.4	2.0	8.0
		2.4	2.6		18		1.1	2.0	7.0
		2.4	2.6		19		1.2	2.0	6.0
		2.4	2.6		20		.9	2.0	
		2.5	2.5		21		1.9	2.0	
			2.3		22		1.7	2.0	
		2.4	2.2		23		2.0	2.0	
		2.4	2.1	2.5	24		2.8	2.0	
		2.5	2.2		25		2.9	2.0	
		2.5	1.9	3.0	26		2.9	2.0	
		2.4	1.8	3.0	27		2.05	2.0	
		2.55	1.7	3.0	28		2.0	2.0	
		2.55	1.8	3.4	29	2.6	2.0	2.0	
		2.65	1.7	4.0	30	2.5	2.5	2.0	
		2.95	2.0	9.0	31		2.5		
		2.0	2.0	8.0					

ay.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
02.[b]												
				8.6	6.85	4.1	6.0	4.5	1.95	2.05	1.1	
			2.55	8.4	8.05	5.75	6.15	4.5	1.95	1.8	1.1	
			2.9	8.1	8.2	6.35	6.1	5.65	1.95	1.6	1.1	
			3.1	7.95	8.2	6.5	6.0	4.05	2.4	2.0	1.45	
			3.0	7.55	6.4	7.55	5.8	4.05	2.35	2.05	1.3	
			2.95	7.15	6.05	7.8	5.8	3.8	2.6	2.0	1.45	
			2.7	6.4	6.25	7.5	5.4	3.5	2.55	2.05	1.5	
			2.85	6.6	6.25	7.6	4.8	3.4	2.65	2.05	1.5	
			2.7	6.5	6.7	7.7	4.75	3.4	2.7	2.0	2.0	
			2.6	6.45	6.35	7.8	4.5	3.4	2.65	1.8	2.0	
			2.6	6.3	6.7	6.7	4.55	3.5	2.6	1.6	2.0	
			2.0	5.35	6.8	6.4	4.5	3.5	2.55	1.6	2.1	
			1.6	5.5	6.7	6.1	5.8	3.3	2.5	1.95	2.05	
			1.6	5.3	7.1	5.8	4.95	3.35	2.45	2.0	2.1	
			1.5	5.25	6.9	7.3	4.65	3.15	2.4	2.05	2.0	
			1.45	5.6	5.5	5.7	4.75	3.0	2.3	2.2		
			2.0	5.6	5.75	5.55	4.65	3.05	2.1	2.2		
			2.55	5.7	5.3	5.45	4.65	3.0	2.0	1.6		
			2.9	5.9	5.5	5.9	4.65	2.95	2.0	2.0		3.0
			3.8	5.85	4.5	5.9	4.65	2.75	2.0	2.1		3.0
			4.0	6.1	4.9	4.7	4.65	2.85	2.5	2.5		3.0
			4.3	6.25	4.9	5.5	4.5	2.8	2.8	2.35		3.0
			4.4	5.8	4.8	5.15	5.2	2.8	2.5	2.55		3.0
			4.3	5.05	5.0	5.2	3.8	2.8	2.05	2.45		3.0
			3.85	4.4	5.6	6.1	2.7	2.8	2.45	2.6		3.0
			3.5	3.75	6.5	5.3	2.9	2.6	2.0	2.4		3.0
			3.6	4.8	6.5	5.55	3.15	2.2	2.25	2.4		3.0
			4.0	6.05	4.5	4.45	4.25	2.0	2.15	2.55		
			4.35	6.1	4.0	4.3	4.15	2.0	2.1	2.55		
			6.0	6.0	3.75	4.8	4.15	2.0	2.15	2.5		
			7.8		4.6		4.3	2.1		1.8		
03.[c]												
			3.9	2.55	3.45				2.5	2.4	1.3	1.0
			3.8	2.45	3.5				2.55	2.35	1.3	1.0
		3.0		4.45	2.75				2.65	2.3	1.3	1.0
		3.0		6.15	3.1				2.7	2.25	1.3	1.0
		3.0	3.7	6.45	2.9				2.65	2.2	1.3	1.0
		3.0	3.65	7.05	3.3				2.75	2.2	1.3	1.0
		3.0	3.6	6.8	3.1				3.0	2.2	1.3	1.0
		3.05	3.55	6.8	3.65				2.9	2.1	1.3	1.0
		3.3	3.6	6.8	4.3				2.9	1.65	1.3	1.0
		3.3	3.65	6.9	3.55				2.75	1.5	1.3	1.0
		3.35	3.9	6.9	3.55				2.65	1.5	1.2	1.05
		3.45	2.75	5.95	3.9				2.6	1.65	1.2	1.0
		3.35	2.75	3.2	3.85				2.6	1.6	1.2	1.05
		3.3	3.0	3.65	4.15				2.6	1.6	1.2	1.3
		3.25	3.05	5.65	3.45				2.5	1.1	1.2	1.25

[a] Ice conditions December 30 to 31, 1901.
[b] River frozen January 1 to March 1 and December 28 to 31, 1902.
[c] River frozen January 1 to February 2, 1903.

Daily gage height, in feet, of Kennebec River at The Forks.—Continued

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1903.										
16		3.2	3.05	6.4					2.5	1.7
17		3.2	3.0	6.95					2.5	1.7
18		3.2	2.9	7.05					2.4	1.9
19		3.2	2.75	6.85					2.45	1.85
20		3.2	3.15	6.75					2.35	1.8
21		3.2	3.75	6.55					2.25	1.7
22		3.2	3.85	6.45					2.2	1.65
23		3.2	4.05	6.3				3.45	2.6	1.5
24		3.2	4.1	6.05				2.9	2.6	1.5
25		3.2	4.45	5.6				2.85	2.55	1.55
26		3.25	4.05	3.1				2.6	2.45	1.5
27		4.2	3.7	3.0				2.6	2.4	1.5
28		4.2	3.35	3.7				2.5	2.45	1.5
29			3.05	3.85				2.6	2.4	1.5
30			2.7	3.5				2.55	2.4	1.5
31			2.75					2.5		1.3
1904.										
1	1.9	2.3	[c]2.4	2.0	4.85				3.05	2.0
2	[d]1.9				4.25				3.1	2.35
3				1.5	3.7				3.6	2.05
4		[c]2.3		.8	3.5				4.1	1.85
5				.8	3.4				4.05	1.95
6				.9	3.4				3.85	1.5
7	[c]2.0		[c]2.2	1.1	3.3				3.3	1.35
8			2.4	[g]1.2	3.3				3.05	1.3
9	[c]1.9		2.5	[g]6.8	3.2				2.9	1.3
10			[c]2.5	[g]2.6	3.7				2.8	1.6
11		[c]2.6		[g]3.2	5.3				2.7	2.3
12	[c]1.9	[h]2.6	[c]2.3	[g]3.7	4.8				2.6	2.85
13	1.9	[h]2.6		2.8	4.0				2.6	3.05
14	2.1			2.8					2.65	3.1
15		2.6		3.1					2.95	3.1
16	[c]2.0		[c]2.1	3.1					2.2	3.05
17				2.9					1.9	3.0
18		[c]2.1		1.8					1.8	2.65
19	[c]2.0		2.3	2.1					1.7	2.4
20		2.1	[h]2.1	1.7					1.5	2.3
21	[c]2.0		2.1	1.7					1.5	2.25
22	[c]2.0			1.8					1.7	2.35
23				1.9				1.5	1.75	2.3
24			2.1	2.65				1.75	2.0	2.05
25	[c]2.0		2.4	3.35				2.0	2.6	2.4
26			2.4	3.2				2.25	2.6	2.25
27		[c]2.1	2.1	3.25				2.55	2.55	2.0
28	[c]2.3		2.3	3.3				3.1	2.7	1.7
29	[c]2.1		2.3	3.4				3.2	2.55	1.8
30			2.1	3.95				3.1	2.7	1.55
31			2.2					3.1		1.5

[a] Readings December 16 to 31, 1903, through ice.
[b] During frozen season 1904 gage readings are to surface of water in hole cut in ice.
[c] Ice 2.2 feet thick.
[d] Ice 1.4 feet thick.
[e] Ice 2 feet thick.
[f] Anchor ice caused backwater effect on gage; estimated as follows: December 4, 0.4 foot; 5, 6, 0.3 foot; December 7, 0.5 foot; December 8, 10, 0.6 foot; December 9, 11, 0.7 foot.
[g] Ice from Dead River formed a jam a short distance below gage and caused backwater.
[h] Ice 2.1 feet thick.

Daily gage height, in feet, of Kennebec River at The Forks—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.[a]												
.....	4.8	5.1	.....	2.95	4.25	.....	.....	1.4	2.7	1.6	1.6	1.3
.....	4.7	5.1	.....	2.85	2.55	.....	.....	3.3	2.7	1.6	1.6	1.3
.....	4.8	5.2	4.5	2.6	2.35	.....	.....	2.9	2.4	1.6	1.5	1.3
.....	4.8	5.2	.....	2.05	3.25	.....	.....	2.65	2.3	1.6	1.5	1.3
.....	4.9	5.2	.....	1.75	3.3	.....	.....	2.55	2.3	1.6	1.5	1.3
.....	4.7	5.1	.....	1.6	2.55	.....	.....	2.5	2.0	1.55	1.5	1.3
.....	4.5	5.1	.....	1.9	.....	.....	.....	2.55	1.8	1.45	1.5	1.2
.....	4.2	5.1	.....	2.1	.....	.....	.....	2.75	1.85	1.4	1.5	1.15
.....	4.5	5.1	.....	2.1	.....	.....	.....	2.9	1.9	1.4	1.5	1.1
.....	4.2	4.9	.....	2.1	.....	.....	.....	2.8	1.9	1.5	1.5	1.1
.....	4.2	4.7	4.0	2.25	.....	.....	.....	2.8	1.9	1.4	1.5	1.1
.....	4.3	4.8	.....	2.5	.....	.....	.....	2.8	2.0	1.4	1.5	1.2
.....	4.4	4.8	.....	2.75	.....	.....	.....	2.8	2.0	1.4	1.5	1.2
.....	4.4	4.8	.....	2.8	.....	.....	.....	2.9	2.0	1.4	1.5	1.3
.....	4.3	4.7	.....	2.8	.....	.....	.....	2.8	2.0	1.35	1.5	1.3
.....	4.4	4.8	.....	2.75	.....	.....	.....	2.8	2.0	1.3	1.5	.....
.....	4.5	4.8	.....	2.55	.....	.....	.....	2.8	1.9	1.25	1.5	.....
.....	4.5	.....	3.8	2.3	.....	.....	.....	2.75	1.8	1.2	1.4	3.7
.....	4.6	.....	.....	2.05	.....	.....	.....	2.65	1.8	1.2	1.4	.....
.....	4.5	.....	3.6	2.15	.....	.....	.....	2.6	1.8	1.2	1.35	.....
.....	4.5	4.9	3.5	1.9	.....	.....	.....	2.6	1.8	1.2	1.3	.....
.....	.....	.....	3.5	2.3	.....	.....	.....	2.5	1.7	1.2	1.3	.....
.....	4.6	.....	3.5	2.4	.....	.....	.....	2.5	1.7	1.2	1.15	.....
.....	4.9	4.7	3.5	2.0	.....	.....	.....	2.5	1.7	1.2	1.1	.....
.....	4.9	.....	3.4	2.0	.....	.....	.....	2.85	1.7	1.45	1.2	3.4
.....	4.9	.....	2.55	2.15	.....	.....	.....	2.75	1.6	1.55	1.2	.....
.....	5.0	.....	2.3	2.55	.....	.....	.....	2.75	1.5	1.7	1.2	.....
.....	5.0	.....	2.35	2.65	.....	.....	.....	2.75	1.4	1.7	1.2	.....
.....	5.0	.....	2.25	2.65	.....	.....	.....	2.75	1.5	1.7	1.2	.....
.....	5.0	.....	2.0	2.55	.....	.....	.....	2.7	1.6	1.6	1.3	.....
.....	5.0	.....	2.3	.....	.....	.....	.....	2.7	.....	1.6	.....	.....

conditions January 1 to March 26 and December 16–31, 1905. January 24, gage reader estimates ıter effect of 0.2 foot due to ice; channel open 80 feet wide at the gage. January 29, channel ıout 10 feet wide at the gage. February 1, river frozen over at the gage. Most of the ice went ing the week of March 20–26. December 18, rise in river due to anchor ice; estimated gage height,

During frozen period gage heights are to the surface of the water in a hole cut in the ice. The ıg comparative readings were taken:

Date.	Water surface.	Top of ice.	Thickness of ice.
1905.	*Feet.*	*Feet.*	*Feet.*
ry 21	4.9	4.9	0.2
ry 24	4.7	4.7	.8
3	4.5	4.1	.9
11	4.0	4.2	1.0
18	3.8	3.8	1 0
ber 18	3.7	3.7	.25
ber 25	3.4	3.4	.3

Daily gage height, in feet, of Kennebec River at The Forks—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.[a]												
1					3.45	4.8	4.3	3.9	3.3	1.6	1.05	0.8
2					4.25	5.4	5.0	3.9	3.3	1.7	.75	.8
3		4.7			4.45	5.2	4.8	3.95	3.15	1.7	1.0	1.0
4					4.45	3.9	4.6	3.25	3.0	1.7	1.45	1.45
5					4.65	5.0	4.9	3.6	2.75	1.7	1.3	1.8
6	2.9				4.75	6.05	4.7	3.7	2.7	1.6	1.3	1.85
7				2.4	4.55	6.2	4.65	3.3	2.7	1.6	1.25	.....
8					3.8	5.85	4.7	3.1	2.7	1.6	1.3	.....
9			4.3		3.85	4.9	4.7	3.75	2.7	1.6	1.3	.....
10		4.7			5.1	4.95	4.9	2.9	1.8	2.25	1.6	.....
11					6.0	5.0	4.75	2.8	2.6	2.9	1.55	.....
12					4.0	5.1	4.8	2.8	2.5	3.35	1.6	3.5
13	1.8				4.05	4.7	4.65	2.75	2.65	2.65	1.6	.....
14				2.2	4.5	4.35	4.15	2.7	2.6	1.75	1.1	.....
15				2.3	4.4	4.7	4.1	3.4	2.6	.9	1.0	.....
16			4.5	3.9	4.8	4.25	3.95	3.15	2.55	1.1	.7	.....
17		5.5		5.15	5.95	3.95	3.65	3.0	2.5	1.2	.6	.....
18				5.95	6.9	4.35	3.4	2.95	2.35	1.2	.6	.....
19				4.75	6.5	4.65	3.15	2.8	2.3	1.45	.95	.....
20	2.7			3.35	6.4	4.65	2.85	2.75	1.65	1.75	.75	.....
21				3.25	6.4	4.65	2.75	2.7	1.4	2.0	1.0	3.0
22				3.4	6.7	4.7	2.75	2.7	1.35	2.2	1.4	.....
23				[b]3.45	5.9	4.65	2.7	2.85	1.4	2.2	1.45	.....
24		4.6	4.5	3.3	6.75	3.8	2.55	2.9	1.4	2.3	1.4	.....
25				3.0	6.4	1.9	3.1	2.8	1.4	2.55	.85	.....
26				3.0	5.6	2.15	3.8	2.8	1.4	2.85	.7	.....
27				2.75	6.05	4.95	3.4	2.8	1.4	2.25	.7	.....
28	4.6			2.7	6.2	4.6	3.4	3.35	1.4	2.0	.7	.....
29				2.7	5.95	4.5	3.7	3.5	1.4	1.9	.8	2.8
30				3.15	4.95	3.75	3.9	3.4	1.4	1.5	.8	.....
31			2.9		5.35	.....	3.9	3.4	.....	1.25	.....	.....

[a] Ice conditions January 1 to April 20, 1906, when ice went out. January 28 to February 17, ice jam 1 mile long extended above and below the station. River also frozen over December 7 to 31, 1906. Gage heights affected by backwater December 4 to 6. During frozen period gage heights are to surface of water in a hole cut in the ice. The following comparative readings were taken:

Date.	Water surface.	Top of ice.	Thickness of ice.
1906.	*Feet.*	*Feet.*	*Feet.*
January 6	2.9	2.9	0.9
January 13	1.8	1.6	1.2
January 20	2.7	2.6	1.5
January 28	4.6	4.6	1.5
February 3	4.7	4.7	1.5
February 10	4.7	4.7	1.7
February 17	5.5	5.5	1.5
February 24	4.6	4.6	1.9
February 28	4.28	4.30	1.9
March 9	4.3	4.3	2.1
March 24	4.5	4.4	2.5
April 7	2.4	1.8	(1)
April 14	2.2	.....	(1)
December 12	3.5	3.2	.4
December 21	3.0	.....	.9
December 29	2.8	2.8	1.0

[1] Ice not safe.

[b] Gage heights April 23 to August 9, 1906, are the mean of four observed gage heights.

ng table for Kennebec River at The Forks from September 29, 1901, to December 31, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	340	1.90	1,220	3.20	2,775	5.00	6,525
0.70	390	2.00	1,305	3.30	2,935	5.20	7,050
0.80	445	2.10	1,395	3.40	3,100	5.40	7,590
0.90	505	2.20	1,490	3.50	3,270	5.60	8,140
1.00	565	2.30	1,590	3.60	3,450	5.80	8,720
1.10	630	2.40	1,700	3.70	3,635	6.00	9,315
1.20	695	2.50	1,815	3.80	3,825	6.50	10,870
1.30	765	2.60	1,935	3.90	4,020	7.00	12,520
1.40	835	2.70	2,060	4.00	4,220	7.50	14,250
1.50	910	2.80	2,190	4.20	4,635	8.00	16,070
1.60	985	2.90	2,325	4.40	5,070	8.50	17,950
1.70	1,060	3.00	2,470	4.60	5,535	9.00	19,890
1.80	1,140	3.10	2,620	4.80	6,020		

his table is applicable only for open-channel conditions. It is based on 14 discharge measurements during 1901–1906. It is well defined between gage heights 0.9 foot and 5 feet. The extension above is based on the extension of the area and velocity curves, the latter being determined by means bles based on Kutter's formula.

Daily discharge, in second-feet, of Kennebec River at The Forks.

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1903.					1904.				
		5,050	6,090	3,470	17	5,530	7,340	5,570	4,060
		4,960	5,010	3,350	18	5,890	5,630	6,130	3,290
		4,630	4,730	3,000	19	8,220	5,630	5,660	3,290
		4,790	4,310	3,070	20	7,100	8,860	5,620	3,130
		4,820	4,450	2,990	21	6,110	8,030	5,210	1,670
		3,810	5,600	3,110	22	2,570	7,200	6,580	1,620
		4,650	4,230	3,140	23	7,000	5,600	5,310	.....
		4,710	5,010	2,880	24	4,630	4,970	5,650	.....
		4,780	5,010	2,950	25	8,100	5,010	5,190	.....
		4,820	5,010	2,950	26	5,180	5,460	4,570	.....
		4,670	5,080	3,110	27	5,400	6,070	4,290	.....
		4,960	4,850	2,990	28	5,140	5,920	4,120	.....
		1,880	5,190	2,840	29	6,460	5,730	4,960	.....
		2,060	5,080	2,740	30	6,460	5,420	4,020	.....
		1,600	4,970	2,530	31	6,460	.....	3,310	.....
	6,830	1,260	4,640	2,570					
	5,310	1,060	4,790	3,770	1905.				
	5,310	990	5,160	2,920	1	.....	5,310	5,310	.....
	3,920	5,150	4,850	2,920	2	.....	5,080	5,310	.....
	6,290	1,140	4,430	2,990	3	.....	4,930	5,010	.....
	3,660	4,930	4,150	3,470	4	.....	4,930	4,870	.....
	2,960	4,930	4,120	3,580	5	.....	4,930	4,870	.....
	2,200	4,970	4,120	.....	6	.....	4,930	4,500	.....
	1,750	5,120	4,120	.....	7	2,990	4,930	4,460	.....
	2,760	6,000	4,120	.....	8	2,415	4,930	4,460	.....
	2,760	5,080	4,120	.....	9	3,570	4,780	3,720	.....
	3,440	5,620	4,150	.....	10	4,520	5,250	4,390	.....
	4,590	7,070	4,060	.....	11	4,520	5,440	3,810	.....
	3,560	6,090	3,760	.....	12	4,830	5,360	4,040	.....
	2,330	6,050	3,720	.....	13	5,930	5,320	4,040	.....
	2,220	.....	3,470	.....	14	4,900	5,490	4,040	.....
					15	4,040	5,530	4,040	.....
1904.					16	3,170	5,320	4,040	.....
		6,120	5,730	1,690	17	3,770	5,450	3,810	.....
		5,450	5,820	1,970	18	4,390	5,330	3,690	.....
		8,330	6,860	3,810	19	3,590	5,330	3,860	.....
		6,460	6,560	3,810	20	6,700	5,330	4,060	.....
		7,940	6,340	3,940	21	2,760	4,900	4,300	.....
		6,460	5,510	3,810	22	5,620	5,580	4,300	.....
		8,930	5,560	3,550	23	5,620	5,230	4,420	.....
		4,840	5,500	3,430	24	5,770	5,400	3,490	.....
		5,780	5,540	3,550	25	5,770	5,150	3,280	.....
		5,210	5,690	4,210	26	5,310	8,330	3,070	.....
		6,340	5,720	3,980	27	6,060	5,930	3,590	.....
		7,180	6,670	4,820	28	6,060	6,380	3,590	.....
		8,050	7,340	4,530	29	5,310	5,620	3,280	.....
	3,490	8,240	7,170	5,110	30	5,310	5,620	3,380	.....
	4,330	6,700	6,500	3,850	31	5,310	.....	2,980	.....
	4,010	6,410	6,500	1,460					

Monthly discharge of Kennebec River at The Forks.

[Drainage area, 1,570 square miles.]

Month.	Discharge in second-feet.			R
	Maximum.	Minimum.	Mean.	Sec.-ft. p sq. mile
1901.				
October	2,470	505	1,588	1.01
November	1,935	1,060	1,401	0.89
December 8-19	19,890	1,815	7,711	4.91
1902.[a]				
March	15,330	872	3,277	2.09
April	18,330	3,730	9,999	6.37
May	16,810	3,730	9,503	6.05
June[b]	15,330	4,425	9,598	6.11
July[b]	9,775	2,060	6,059	3.86
August[b]	8,267	1,305	2,931	1.87
September	2,190	1,262	1,634	1.04
October	1,935	985	1,428	0.91
November 1-15	1,395	630	1,039	0.66
December 19-27	2,470	2,470	2,470	1.57
1903.[c]				
February 3-28	4,635	2,470	2,910	1.85
March	5,185	2,060	3,259	2.08
April	12,690	1,757	8,349	5.32
May	6,830	1,750	3,545	2.26
June	7,070	990	4,275	2.72
July	6,090	3,470	4,583	2.93
August	3,770	1,820	2,789	1.78
September	2,470	1,490	1,895	1.21
October	1,700	630	1,112	.71
November	765	565	684	.44
December 1-15	765	565	594	.38
1904.[d]				
April 30-30	4,120	1,060	2,291	1.46
May	8,220	2,570	5,059	3.22
June	8,930	4,840	6,510	4.15
July	7,340	3,310	5,652	3.60
August	5,110	910	2,966	1.89
September	4,425	910	2,118	1.35
October	2,620	765	1,564	.99
November	1,947	835	1,334	.85
1905.[e]				
March 26-31	1,875	1,305	1,591	1.01
April	2,400	985	1,666	1.06
May	6,700	1,645	4,330	2.76
June	8,330	4,780	5,408	3.44
July	5,310	2,980	4,065	2.59
August	2,935	835	2,067	1.32
September	2,060	835	1,248	.79
October	1,060	695	864	.55
November	985	630	838	.53
December 1-15	765	630	717	.45
1906.[f]				
April 20-30	3,185	2,060	2,635	1.68
May	12,180	3,185	7,442	4.74
June	9,930	1,220	5,721	3.64
July	6,525	1,875	4,297	2.74
August	4,120	2,060	2,742	1.75
September	2,935	800	1,614	1.03
October	3,018	505	1,269	.80
November	985	340	633	.40

[a] River frozen January 1 to March 1 and December 28-31, 1902.

[b] More or less error is probably caused in the values of June to August, 1902, by great flu river stage. See description of station (p. 34).

[c] River frozen January 1 to February 2 and December 16-31, 1903.

[d] River frozen January 1 to April 9, and December 4-31, 1904.

[e] Ice conditions January 1 to March 26 and December 16-31, 1905.

[f] Ice conditions January 1 to April 19 and December 4-31, 1906.

KENNEBEC RIVER NEAR NORTH ANSON.

This station was established October 18, 1901, by N. C. Grover. It is located 1½ miles east of North Anson and about 1 mile above the mouth of Carrabassett River.

The channel is straight for 500 feet above and 1,000 feet below the station and has a width of about 350 feet, broken by one pier. The current is swift at high stages and moderately rapid at low stages, except near the left bank. The right bank is high and rocky. The left bank is comparatively low and subject to overflow at the time of highest water. The bed of the stream is rocky, with sand over a portion of the section, and is permanent.

Discharge measurements are made from the wooden highway bridge across the Kennebec, known locally as Patterson Bridge. The initial point for soundings is on the left bank, at the outside of the end post of the center truss of the bridge. Low-water measurements are made from a boat about 1,000 feet below the station at a section where there is a better distribution of current.

Numerous measurements under ice cover have been made at this station at a section about 500 feet below the bridge, and a rating curve has been constructed for such conditions. Further details of winter measurements at this point and of rating curve used are given in Water-Supply Paper No. 187.

Considerable fluctuations in the gage heights at this station occur from about May 1 to July 31, owing to the regulation of the flow at Indian Pond dam for log-driving purposes. These fluctuations are, however, less marked than those at The Forks. The daily discharge during this period for the years 1904 and 1905, as given below, is a mean of the discharges corresponding to gage heights of the high and low daily periods, each period being considered as lasting twelve hours.

All estimates previously published have been revised.

Gage readings are made twice each day by Mrs. C. S. Benjamin, the toll collector at the bridge. There are three gages—one, for ordinary stages, is a vertical rod fastened to the bridge pier; another, for high-water observations, is a vertical rod attached to the right abutment; the third, for low-water stages, is a standard chain gage attached to the wooden truss on the upstream side of the bridge. The length of the chain January 9, 1906, was 30.13 feet. The gage datum is 243.83 feet above mean sea level, as determined by the Kennebec River survey of 1904 and readjusted in 1906. The datum of the three gages is the same and is referred to bench marks as follows: (1) A copper bolt in a bowlder on the right bank, about 100 feet above the bridge, elevation 10.66 feet; (2) a marked point on the bottom chord of the bridge near the chain gage, elevation January 9, 1906, 24.81 feet.

Elevations refer to the datum of the gage. The bridge at bench mark 2, and hence the bench mark, has settled about 0.3 foot in eighteen months. The gage has been corrected several times by level during this period, however, and it is believed that no error of consequence in the gage readings has resulted.

The monthly means as given herewith for open-channel conditions for discharges greater than 1,600 and less than 10,000 second-feet are considered to be within 5 per cent of the true flow. Outside of these limits the error may be somewhat greater. Monthly means of flow under ice cover are considered to be correct within 10 per cent, except where unsatisfactory conditions are noted. Daily discharges are subject to much larger errors, particularly above gage height 8.0 feet and below 2.0 feet and during the log-driving period.

Discharge measurements of Kennebec River near North Anson.

Date.	Gage height.		Discharge.	Date.	Gage height.		Discharge.
	To water surface.	To bottom of ice.			To water surface.	To bottom of ice.	
1901.	*Feet.*	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Feet.*	*Sec.-ft.*
October 14	3.20	.....	3,120	June 10	6.00	.....	8,380
October 18	3.00	.....	2,460	July 26	2.94	.....	2,400
				August 30	3.43	.....	3,210
1902.				1905.			
July 29	4.55	.....	6,220	February 9	5.27	3.27	2,080
				February 9	5.32	3.32	2,140
1903.				April 19	4.26	.....	5,000
March 28	6.50	.....	11,400	July 20	3.72	.....	3,770
May 27	3.25	.....	3,130	October 27	2.30	.....	1,320
June 15	6.80	.....	11,100				
June 16	4.90	.....	6,740	1906.			
June 16	4.38	.....	5,580	January 9	3.58	2.58	1,290
July 17	3.25	.....	2,960	January 10	3.40	2.22	1,120
August 15	3.78	.....	4,000	January 10	3.56	2.38	1,180
September 24	2.85	.....	2,500	March 2	4.26	2.43	1,590
November 6	2.00	.....	1,200	March 3	4.08	2.27	1,380
				March 30	4.77	2.67	1,600
1904.				March 30	4.80	2.70	1,660
January 27	3.40	1.55	749	April 11	4.70	2.80	1,660
January 28	3.40	1.55	786	April 11	4.70	2.80	1,710
March 2	3.55	1.45	529	May 10	7.06	.....	11,700
March 4	3.65	1.55	572				

Daily gage height, in feet, of Kennebec River near North Anson.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1901.[a]				1901.			
1	.....	3.0	4.9	17	.....	2.7	.....
2	.....	3.0	5.0	18	.....	2.7	.....
3	.....	2.85	5.3	19	.....	2.7	.....
4	.....	3.1	.....	20	2.45	2.7	.....
5	.....	3.0	.....	21	2.3	2.7	.....
6	.....	2.9	.....	22	2.25	2.85	.....
7	.....	2.7	.....	23	2.2	2.75	.....
8	.....	2.5	.....	24	2.55	2.5	.....
9	.....	2.55	.....	25	2.85	2.7	.....
10	.....	2.55	.....	26	2.8	2.7	.....
11	.....	2.35	.....	27	2.7	2.8	.....
12	.....	2.5	.....	28	2.7	4.55	.....
13	.....	2.55	.....	29	2.7	5.15	.....
14	.....	2.85	.....	30	2.75	5.0	.....
15	.....	2.75	.....	31	2.9	.....	.....
16	.....	2.75	.....				

[a] River frozen November 28 to December 31, 1901.

aily gage height, in feet, of Kennebec River near North Anson—Continued.

y.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
a												
				12.65	9.25	6.95	6.1	4.1	3.25	3.15	5.1	3.25
				11.7	10.45	6.7	5.85	4.5	3.35	3.25	3.95	3.4
				10.75	11.3	6.1	5.85	5.3	3.15	3.0	3.5	3.5
				9.0	9.4	7.4	5.6	4.85	3.0	2.95	3.25	3.45
				7.9	7.55	8.75	5.45	4.5	3.45	2.9	3.1	3.35
				7.0	7.25	8.9	5.35	4.15	3.35	3.1	3.15	.....
				7.15	7.55	8.95	5.05	4.2	3.2	3.25	3.1	.....
				7.2	8.6	8.6	5.0	4.15	3.45	3.45	3.05	.....
				7.45	8.15	9.9	4.8	4.25	3.35	3.3	3.05	.....
				7.0	7.9	9.25	4.85	4.2	3.75	2.9	3.2	.....
				6.9	6.45	8.3	5.0	4.2	3.95	2.8	3.05	.....
				6.85	7.45	7.65	5.0	4.4	3.65	2.65	2.95	.....
				6.75	6.95	6.7	5.05	4.15	3.4	2.9	3.2	.....
				6.3	6.95	6.45	4.9	3.7	3.8	3.05	3.35	.....
				6.5	5.95	6.3	4.9	3.6	4.1	3.15	3.6	.....
				6.85	5.8	6.1	5.55	3.65	3.95	3.4	3.85	.....
				6.75	5.75	6.2	5.1	3.2	3.5	3.2	4.05	.....
				6.05	5.75	6.25	5.2	3.0	3.1	3.1	4.1	.....
				6.8	5.35	5.65	5.1	2.55	3.05	3.05	4.0	.....
				6.55	5.15	5.55	5.3	2.7	3.25	3.7	3.85	.....
				7.35	5.35	5.2	5.55	3.2	4.0	3.65	3.85	.....
				7.15	5.55	5.65	5.55	3.15	4.25	3.95	3.85	.....
			11.3	7.55	5.8	5.55	5.25	3.8	4.0	3.9	3.7	.....
			8.75	7.3	5.9	6.1	5.25	4.15	3.9	3.65	3.8	.....
			7.75	6.3	5.8	5.65	5.05	4.15	3.3	3.5	3.65	.....
			6.65	6.55	6.65	6.75	5.05	3.65	3.0	3.0	3.45	.....
			6.05	6.55	7.65	7.45	5.0	3.25	3.0	2.95	3.4	.....
			5.75	6.85	8.25	6.6	4.65	3.15	3.05	3.65	3.15	.....
			7.55	7.1	9.25	5.95	4.4	3.0	3.2	5.95	3.15	.....
			11.6	7.65	7.55	5.7	4.45	2.85	3.15	5.85	3.15	.....
			11.35	.....	7.3	.....	4.25	2.95	.....	5.8	.....	.....
b												
				4.85	5.8	3.9	4.55	4.25	3.2	2.9	1.55	2.9
				4.9	5.55	3.5	3.4	3.9	3.1	3.05	1.9	.....
				5.25	4.8	3.1	4.2	3.85	3.05	3.05	1.85	.....
				6.2	4.9	3.6	4.0	3.65	3.05	2.95	1.7	.....
				8.2	5.2	3.5	3.85	3.75	3.05	3.05	2.0	.....
				8.05	6.35	3.45	3.8	3.85	3.0	2.95	2.0	.....
				7.8	5.7	3.25	3.75	3.65	3.35	3.05	2.1	.....
				7.55	6.2	2.95	3.4	3.5	3.3	3.1	2.25	1.8
				7.7	6.3	3.1	3.25	3.6	3.1	3.1	2.45	.....
				8.35	5.0	3.95	3.6	3.6	3.1	2.95	2.3	.....
				8.05	5.65	4.25	3.65	3.45	3.15	2.35	2.25	.....
				7.95	6.0	4.25	3.65	3.75	3.2	2.4	2.05	.....
				6.25	5.45	8.55	3.55	3.7	3.1	2.55	2.25	.....
				6.4	5.1	8.55	3.45	3.5	2.95	2.45	2.1	.....
				6.6	5.25	6.5	3.2	3.5	3.05	2.25	2.05	.....
				7.75	4.55	4.65	3.55	3.0	3.15	1.95	2.15	1.9
			13.0	7.65	5.55	4.0	3.5	3.4	3.1	2.3	2.0	.....
			12.5	7.3	4.95	3.55	3.2	3.0	3.05	2.35	1.95	.....
			13.25	6.95	4.7	4.5	3.95	3.2	3.0	2.5	2.05	1.6
			14.5	7.1	4.4	4.9	3.35	3.05	2.9	2.95	2.05	.....
			14.95	6.7	5.0	4.65	3.25	3.75	3.05	2.95	2.0	.....
			13.0	6.7	4.65	4.45	3.6	4.15	3.15	2.9	1.95	.....
			12.5	7.0	5.2	4.3	3.95	4.25	3.1	2.4	2.05	.....
			12.0	6.7	4.35	3.95	4.4	3.7	3.0	2.15	1.95	.....
			11.0	6.15	4.6	4.35	4.35	3.25	3.25	1.7	1.9	.....
			10.0	5.6	4.45	4.5	4.3	3.35	3.25	2.15	2.7	2.1
			9.05	4.4	5.25	4.25	4.2	3.35	3.2	2.4	2.85	.....
			7.25	4.3	4.95	4.25	3.1	3.3	3.2	2.3	2.95	.....
			5.75	5.1	4.05	4.35	3.4	3.3	2.95	2.2	2.95	.....
			5.1	4.95	3.7	4.15	3.8	3.15	2.95	1.95	2.95	.....
			4.65	.....	4.0	.....	4.4	3.2	.....	1.9	.....	.....

frozen January 1 to March 22, and December 6–31, 1902.
frozen January 1 to March 16 and December 2–31, 1903. Gage readings during the latter period
to the bottom of the ice. Thickness of ice during December was estimated as follows:
r 8, 0.5 foot; December 16, 1 foot; December 19, 1.3 feet; December 26, 1.4 feet.

Daily gage height, in feet, of Kennebec River near North Anson—Continued.

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				12 8	9 85			5.0	3.4	5.7	3.05	
2				12 9	8 75			4.5	3.4	5.05	2.95	
3				12 9	8 7			4.2	3.65	4.55	2.75	
4				12 9	8 75			4.4	4.2	3.95	2.75	
5				12 9	8 25			4.7	4.65	3.8	2.75	
6				8 0	7 4			4.8	4.25	3.4	2 8	
7				8 2	7 15			4.1	4.0	3 15	3 15	
8				8 5	8 05			4.5	3.8	3.0	3 45	
9				8 8	8 7			3.6	3.6	2.95	3 33	
10				12 85	9 1			3.45	3.45	2.95	3 15	
11				8 45				3 25	3.15	3.15	3 2	
12				13 1				3.3	3.2	3.35	3 2	
13				8 6				3.9	3.15	3.7	3 15	
14				8 8				3.5	3.15	3.8	3 1	
15				8 0				3.4	3.45	3.75	3 15	
16				4 9				3.95	3.95	3.75	3.15	
17				4 4				4.9	3.9	3.9	3 3	
18				4 0				4.5	3.4	3.75	3 15	
19				5 65				3.65	3.2	3.3	3.05	
20				4 25				3.85	3.0	3 25	2 95	
21				4 1				4 2	2.9	3.2	3 0	
22				3 8				3.7	3.05	4 7	3 4	
23				4 15				3.8	3.0	4 8	3 2	
24				4 8				3.0	3.05	4 55	3 25	
25				5 6				3.0	3.3	4.2	3 15	
26			m 2 2	5 9				2.85	3.8	3.75	3 2	
27				6 0				2.95	3.8	4 15	3 2	
28				6 15				3.25	3.8	4 2	3 35	
29				7 05				3.5	4.0	3.5	3 1	
30				8 95				3.4	5.1	3.3	3 75	
31								3.4		3.2		

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				9 45				2.95	3.25	2 3	2 2	
2				8 35				3.45	3.2	2 3	2 25	
3				8 95				4.15	2.95	2.3	2 15	
4				9 4				3.45	2.95	2.3	2 3	
5				8 4				3.3	3.1	2.3	2 2	
6				8 1				3.2	3.05	2 25	2 3	
7				8 9				3.3	2.95	2 1	2 3	
8				9 25				3.35	2 9	2.1	2 3	
9				8 5				3.4	2.75	2 1	2 3	
10				7 0				3.35	2.75	2 1	2 35	
11				5 35				3.35	2.65	2 1	2 25	
12				5 5				3.3	2.55	2.1	2 2	
13				5 5				3.3	2.6	2 05	2 2	
14				4 9				3.4	2.5	2 0	2 25	
15				5 05				3.45	2.55	2 0	2 2	

a During frozen season, 1904, gage readings are to the bottom of the ice.
b Ice 2 feet thick.
c River frozen over.
d Ice 2.5 feet thick.
e Ice 1.9 feet thick.
f Ice 0.35 foot thick.
g Ice 1.85 feet thick.
h River ice-covered.
i Ice 2.4 feet thick.
j Ice 0.6 foot thick.
k Ice 2.7 feet thick.
l Ice 0.9 foot thick.
m Ice 2.2 feet thick.
n Ice 1.8 feet thick.
o River frozen January 1 to about March 27, 1905, when river was probably clear of ice. Also ice conditions December 1–31, the river being frozen with the exception of channels in each span, which were probably open during the whole month. Gage heights December 18, 22, and 28 probably affected by back water from anchor ice. During frozen period gage heights are to the bottom of the ice.
p Ice 2.3 feet thick.
q Ice 0.4 foot thick.

ly gage height, in feet, of Kennebec River near North Anson—Continued.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
				4.9				3.45	2.65	2.1	2.15	[a] 2.8
				4.65				3.35	2.4	2.05	2.4	
		[b] 3.0	[c] 2.4	4.5				3.55	2.7	2.1	2.8	[d] 2.7
				4.3				3.5	2.75	1.95	2.1	
				4.3				3.4	2.75	1.9	1.95	
	[c] 3.6			4.35				3.2	2.85	1.9	2.1	
				4.95				3.05	2.8	1.9	2.0	[d] 4.9
				4.65				3.05	2.7	2.0	2.0	
				4.7				2.95	2.6	1.95	2.1	
		[b] 3.2	[f] 2.8	4.75				2.95	2.5	2.0	2.1	
				4.4				3.15	2.35	2.05	2.15	
			6.8	4.95				2.7	2.35	2.25	2.3	
	[c] 3.4		6.9	4.7				2.4	2.3	2.2	2.45	[g] 4.7
			7.9	4.9				2.7	2.3	2.25	2.7	
			8.45	4.95				3.35	2.3	2.3	2.95	
			8.95					3.2		2.2		
	2.5				6.3	5.9	4.45	3.75	4.05	2.9	3.5	2.7
			2.4		7.1	5.85	4.65	3.8	3.95	2.85	3.3	4.3
		2.3	2.3	2.4	7.75	6.8	4.85	3.7	3.8	2.75	3.1	
					8.25	5.1	4.7	3.8	3.85	2.7	3.35	
					7.4	5.0	4.55	3.7	3.75	2.65	3.4	4.2
					8.0	5.25	4.3	3.4	3.65	2.7	3.3	4.15
				2.7	7.5	6.75	4.55	3.35	3.65	2.8	3.1	4.05
	2.5		2.2		6.8	7.45	4.7	3.3	3.6	2.85	3.1	4.0
	2.4				6.4	7.1	4.75	3.3	3.6	2.85	3.1	3.8
	2.2	2.2			7.25	6.2	4.5	4.0	3.6	4.8	3.25	
				2.8	9.2	6.15	3.8	3.6	3.55	4.85	3.2	
					7.7	5.75	5.05	3.55	3.3	4.6	3.25	3.6
			2.2		6.75	5.15	5.05	3.6	3.5	3.9	3.35	
	2.5			2.8	6.8	5.15	4.9	3.55	3.45	3.45	3.05	
					7.0	4.75	4.6	3.8	3.3	3.05	2.95	
					6.5	5.0	4.25	3.8	3.2	3.0	2.75	3.1
	2.5	2.1	2.3		6.8	4.35	4.0	3.7	3.2	2.7	2.75	
				10.0	7.7	4.45	4.25	3.65	3.2	2.85	2.4	
				9.5	8.05	4.5	4.15	3.6	3.2	2.85	2.55	
	1.9		2.0	8.05	7.35	4.85	4.2	3.55	3.2	2.95	2.8	
				6.85	7.55	4.35	4.15	3.55	3.1	3.45	3.05	
				7.2	7.35	4.4	4.5	3.5	3.0	3.65	3.2	
				7.85	6.35	4.4	4.65	3.5	2.85	3.7	3.2	3.3
		2.5	2.2	7.2	6.9	4.75	4.65	3.5	3.0	4.0	3.15	
				6.15	6.2	3.6	5.05	3.7	2.95	4.15	3.0	
				5.85	6.5	3.75	4.6	3.5	2.9	5.25	2.9	
	3.9		2.2	4.5	6.05	4.95	4.5	3.7	2.85	5.1	2.9	
				5.25	7.8	4.95	3.75	4.05	2.85	4.75	2.75	
			2.6	5.35	6.95	4.65	3.65	4.3	2.85	4.45	2.6	
			2.7	5.55	7.35	4.65	3.5	4.3	2.8	4.1	2.65	3.2
					6.95		3.7	4.1		3.6		

0.6 foot thick.
2.4 feet thick.
2.7 feet thick.

[d] Ice 0.7 foot thick.
[e] Ice 2.3 feet thick.

[f] Ice 2.5 feet thick.
[g] Ice 1 foot thick.

An error in gage heights June 17 to December 31, 1906, was discovered after the manuscript per was sent to the printer. Gage heights as published above for this period are 0.35 foot The monthly discharge, however, as given on p. 48, has been corrected and gives the true river.

rozen January 1 to April 17, 1906; clear of ice the evening of April 18; frozen over December Backwater due to anchor ice during December. Gage readings during the frozen season, the bottom of the ice. The thickness of ice was measured as follows:

Date.	Thickness.	Date.	Thickness.	Date.	Thickness.
1906.	*Feet.*	1906.	*Feet.*	1906.	*Feet.*
	0.9	February 17	1.9	December 6	0.6
	1.0	February 24	1.8	December 7	.7
	1.3	March 2, 4, 8, 13	2.0	December 8	.8
	1.4	March 17, 20	2.1	December 9	1.0
	1.1	March 24, 27, 29, 30	2.3	December 12	1.2
	1.1	April 3, 7	2.1	December 16	1.4
	1.2	April 11	2.0	December 23	1.4
	1.3	April 14	1.9	December 30	1.5
1, 10	1.5	December 5	.4		

Rating tables for Kennebec River near North Anson.

OCTOBER 20, 1901, TO DECEMBER 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	D cha
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec*
1.40	680	3.10	2,785	4.80	6,535	9.00	16.
1.50	760	3.20	2,960	4.90	6,790	8.20	16.
1.60	840	3.30	3,140	5.00	7,050	8.40	17.
1.70	930	3.40	3,330	5.20	7,570	8.60	18.
1.80	1,020	3.50	3,520	5.40	8,050	8.80	19.
1.90	1,110	3.60	3,720	5.60	8,630	9.00	20.
2.00	1,205	3.70	3,925	5.80	9,170	9.50	22.
2.10	1,310	3.80	4,140	6.00	9,730	10.00	24.
2.20	1,430	3.90	4,360	6.20	10,300	10.50	26.
2.30	1,560	4.00	4,590	6.40	10,880	11.00	28.
2.40	1,700	4.10	4,825	6.60	11,480	11.50	31.
2.50	1,840	4.20	5,060	6.80	12,080	12.00	33.
2.60	1,980	4.30	5,300	7.00	12,720	12.50	35.
2.70	2,140	4.40	5,545	7.20	13,370	13.00	38.
2.80	2,290	4.50	5,790	7.40	14,050	14.00	43.
2.90	2,450	4.60	6,035	7.60	14,750	15.00	48.
3.00	2,615	4.70	6,285	7.80	15,470		

JANUARY 1, 1904, TO DECEMBER 31, 1906.[b]

1.90	990	3.50	3,355	5.10	7,053	7.40	13.
2.00	1,080	3.60	3,551	5.20	7,316	7.60	14.
2.10	1,182	3.70	3,752	5.30	7,587	7.80	15.
2.20	1,294	3.80	3,958	5.40	7,858	8.00	16.
2.30	1,415	3.90	4,169	5.50	8,136	8.20	16.
2.40	1,544	4.00	4,385	5.60	8,415	8.40	17.
2.50	1,680	4.10	4,606	5.70	8,700	8.60	18.
2.60	1,822	4.20	4,832	5.80	8,984	8.80	19.
2.70	1,970	4.30	5,062	5.90	9,274	9.00	19.
2.80	2,124	4.40	5,297	6.00	9,565	9.50	21.
2.90	2,284	4.50	5,536	6.20	10,130	10.00	24.
3.00	2,450	4.60	5,779	6.40	10,710	10.50	26.
3.10	2,621	4.70	6,026	6.60	11,310	11.00	28.
3.20	2,797	4.80	6,277	6.80	11,920		
3.30	2,978	4.90	6,532	7.00	12,550		
3.40	3,164	5.00	6,790	7.20	13,200		

DISCHARGE UNDER ICE COVER FROM 1904 TO 1906.[c]

1.40	510	2.30	1,255	3.20	2,075	4.10	2.
1.50	560	2.40	1,340	3.30	2,170	4.20	3.
1.60	670	2.50	1,430	3.40	2,265	4.30	3.
1.70	750	2.60	1,520	3.50	2,360	4.40	3.
1.80	830	2.70	1,610	3.60	2,460	4.50	3.
1.90	915	2.80	1,700	3.70	2,560	4.60	3.
2.00	1,000	2.90	1,790	3.80	2,660		
2.10	1,085	3.00	1,885	3.90	2,760		
2.20	1,170	3.10	1,980	4.00	2,860		

[a] This table is applicable only for open-channel conditions. It is based on 12 discl ments made during 1901-1903. It is well defined between gage heights 2.0 feet and 5.0 f

[b] This table is applicable only for open-channel conditions. It is based on 6 discharg made during 1904-1905 and the form of the 1903 curve. It is well defined between gage and 5.0 feet.

[c] This table is applicable only for ice cover conditions. It is based on 13 discharg made during 1904-1906. It is well defined between gage heights 1.5 feet and 3.4 feet. G to the bottom of the ice.

Daily discharge, in second-feet, of Kennebec River near North Anson.

	May.	June.	July.		May.	June.	July.
1904.				1905.			
		9,560	5,330	1	9,340	6,560	6,540
		9,560	5,980	2	7,720	6,170	6,010
		7,480	6,760	3	7,590	6,210	8,870
		7,480	6,460	4	9,420	5,620	9,080
		8,740	5,840	5	9,870	6,700	8,510
		9,770	5,380	6	9,270	6,780	6,390
		13,920	5,240	7	10,010	6,870	7,810
		12,470	4,940	8	7,590	6,950	4,650
		10,640	4,860	9	10,720	5,230	5,300
		11,360	4,540	10	12,020	5,390	7,900
	17,960	10,950	4,540	11	9,010	6,250	7,190
	27,190	9,130	6,980	12	9,470	6,310	7,060
	17,380	8,440	8,480	13	8,870	7,470	6,200
	12,550	7,810	7,820	14	8,160	8,930	5,860
	9,870	7,110	7,220	15	7,200	9,240	5,820
	23,770	7,090	7,260	16	9,370	8,090	5,360
	24,030	6,400	6,430	17	8,110	7,680	4,270
	16,610	5,640	6,400	18	8,050	6,920	4,060
	13,720	5,700	6,430	19	7,050	7,350	4,390
	13,720	5,820	4,200	20	6,940	8,230	5,140
	10,600	6,870	4,580	21	8,070	8,440	5,140
	11,930	5,980	2,540	22	8,470	9,370	5,380
	10,720	6,600	2,540	23	8,480	8,590	5,150
	9,270	5,110	3,170	24	8,580	5,910	5,020
	8,310	4,790	3,530	25	9,280	5,560	3,990
	9,270	5,200	2,890	26	9,310	6,490	3,990
	9,130	5,470	3,760	27	8,870	7,800	3,830
	8,030	5,610	4,970	28	8,740	7,300	2,940
	10,160	5,280	4,360	29	8,470	6,640	3,120
	10,440	5,100	4,540	30	7,870	6,250	2,620
	9,270		4,590	31	7,420		2,380

Monthly discharge of Kennebec River near North Anson.

[Drainage area, 2,790 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.[a]					
er 20–31	2,450	1,430	1,903	0.714	0.32
nber 1–27	2,785	1,630	2,190	.785	.79
1902.[b]					
23–31	31,460	9,035	19,040	6.82	2.28
	36,420	9,870	14,760	5.29	5.90
	30,080	7,440	13,960	5.00	5.76
	23,780	7,570	12,800	4.59	5.12
	10,010	5,180	7,439	2.67	3.08
it	7,830	1,915	4,188	1.50	1.73
nber	5,180	2,615	3,494	1.25	1.39
er	3,590	2,065	3,661	1.31	1.51
nber	7,310	2,532	4,023	1.30	1.45
iber 1–5	3,520	3,050	3,312	1.19	.22
1903.[c]					
17–31	48,040	6,160	28,220	10.11	5.64
	17,520	5,300	11,800	4.23	4.72
	10,740	2,925	7,315	2.62	3.02
	18,300	2,532	5,760	2.06	2.30
	5,912	2,785	4,040	1.45	1.67
it	5,180	2,615	3,646	1.31	1.51
nber	3,235	2,450	2,791	1.00	1.12
er	2,785	930	1,966	.705	.81
nber	2,532	800	1,450	.520	.58
iber[d]	1,790	670	1,010	.362	.42

[a] River frozen November 28 to December 31, 1901.
[b] River frozen January 1 to March 22; ice conditions December 6–31, 1902.
[c] River frozen January 1 to March 16 and December 2–31, 1903.
[d] Rating table for ice cover used.

Monthly discharge of Kennebec River near North Anson—Continued.

Month.	Discharge in second-feet.			Run-off (sec.-ft. per sq. mile).
	Maximum.	Minimum.	Mean.	
1904.[a]				
January	915	510	690	0.24
February	915	510	680	.24
March	1,700	510	920	.31
April	24,470	1,790	7,440	2.67
May	27,190	8,030	14,220	5.10
June	13,920	4,790	7,703	2.76
July	8,480	2,540	5,244	1.88
August	6,740	2,204	4,094	1.46
September	7,053	2,284	3,598	1.29
October	8,700	2,367	4,058	1.45
November	8,842	2,047	3,030	1.09
December	5,500	1,790	2,750	.98
The year	27,190	510	4,539	1.63
1905.[b]				
January	3,420	2,075	2,660	.95
February	2,265	1,885	2,070	.74
March	19,730	1,340	4,110	1.47
April	21,730	5,062	10,420	3.74
May	12,020	6,940	8,688	3.12
June	9,370	5,230	7,043	2.52
July	5,080	2,380	5,483	1.97
August	4,719	1,544	2,906	1.04
September	2,887	1,415	1,991	.71
October	1,415	990	1,205	.43
November	2,307	1,035	1,349	.48
December	3,950	1,430	2,540	.91
The year	21,730	990	4,205	1.51
1906.[d]				
January	2,760	915	1,680	.60
February	1,430	1,085	1,240	.44
March	1,610	1,000	1,220	.43
April	24,030	1,340	7,120	2.55
May	20,730	9,700	13,250	4.75
June	14,060	2,887	7,100	2.54
July	6,026	2,709	4,584	1.64
August	4,277	2,367	3,057	1.09
September	3,752	1,612	2,455	.88
October	6,532	1,415	2,982	1.07
November	2,709	1,131	1,966	.70
December	2,810	1,479	2,032	.73
The year	24,030	915	4,057	1.45

[a] River frozen January 1 to April 4 and December 1-31, 1904; rating table for ice cover u
[b] River frozen January 1 to March 27 and December 1-31, 1905; rating table for ice cover
[c] Values for the last half of December, 1905, are probably too large, owing to backwat
anchor ice.
[d] River frozen January 1 to April 18 and December 2-31, 1906; rating table for ice cover
given for December, 1906, are probably too high, owing to anchor ice; rating table for ice
December 2-31, 1906.

KENNEBEC RIVER AT WATERVILLE.

Observations of the flow of Kennebec River at Waterv
been made by the Hollingsworth & Whitney Company sin
and furnish the longest set of continuous records of flow of t
This company manufactures manila paper and ground-wood
phite pulp.

The dam is of timber cribwork, the main portion having a
downstream face with a horizontal crest about 5.75 feet wid
upstream slope of about 40° from the horizontal. The ave
vation of the crest of the dam, as determined by levels dur
1906, was 119.37 feet above the Hollingsworth & Whitney d

71.53 feet above mean sea level, according to the Kennebec datum as corrected by levels of 1906. The total length of the dam is 800 feet, which includes a width of log way of 34 feet. Flashboards are kept on the dam the greater part of the time, their average elevation in July, 1906, being 123.73 feet above the Hollingsworth & Whitney datum, or 75.89 feet above mean sea level. The crest of the dam is in fairly good condition. The leakage has never been measured, but is assumed arbitrarily as 100 second-feet. The water which flows in the canals is used through 46 wheels, most of which have been rated at Holyoke under practically the same head, the average head at Waterville being about 23 feet. Some water is lost through the canal, through small waste gates, and over wasteweirs. A small amount, estimated at 100 second-feet, is used for washing and mill purposes.

Methods and diagrams for estimating the flow through the wheels and over the dam were developed by the late Sumner Hollingsworth, engineer for the company. Observations were made at 12 o'clock noon of each day, that hour having been chosen after investigation as a time when the flow is least affected by storage of dams upstream and as giving most nearly the average for the day. When the flow of the river is less than about 3,500 second-feet all of the water is used through the wheels.

The values of flow at this point are probably in error from 10 to 15 per cent, on account of the manner in which the flow has been computed and the uncertainty of the constants used. During the four or five years preceding January 1, 1906, computations are in error from 10 to 15 per cent where the flow has been computed with flashboards, owing to the assumption that the top of the boards was at elevation 124.0 feet above the Hollingsworth & Whitney datum, the results as published being too small.

These records are now being furnished by the Hollingsworth & Whitney Company through the courtesy of their engineer, James L. Dean.

Daily discharge, in second-feet, of Kennebec River at Waterville.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1892.[a]												
1				3,530		11,840	17,355					
2				4,730	7,920		20,030					
3				10,260		11,840						
4				19,100	6,310		29,985					
5				25,250								
6				22,980	8,950	11,515						
7				28,150								
8				24,830		8,200						
9				22,810	9,660							
10						7,925						

[a] November figures are for 1891. The closing of gates at Moosehead Lake is said to have caused the small discharge here recorded.

Daily discharge, in second-feet, of Kennebec River at Waterville.

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1896.										
21	3,000	2,781	12,922	74,469	14,782	5,352	4,391	2,858	4,313	2,[illegible]
22	2,767	2,771	3,239	60,021	13,215	6,073	4,419	2,747	4,207	4,[illegible]
23	2,703	2,162	10,025	41,711	3,976	6,655	4,374	2,739	4,147	8,[illegible]
24	2,542	3,854	7,820	46,693	23,517	6,275	4,258	2,943	3,754	7,[illegible]
25	2,304	2,812	6,608	40,793	14,220	6,334	4,386	2,950	2,924	7,[illegible]
26	1,881	2,790	6,647	36,126	4,482	5,817	3,794	2,851	2,969	[illegible]
27	2,499	2,772	7,253	32,729	5,729	5,459	4,215	2,571	2,474	[illegible]
28	2,765	2,558	10,886	30,217	5,117	5,309	3,781	2,410	3,149	[illegible]
29	2,531	2,704	5,945	30,517	4,867	4,290	3,728	2,416	3,148	[illegible]
30	2,473	.....	6,901	30,977	3,192	5,307	3,335	1,625	2,777	[illegible]
31	2,220	.....	5,006	.....	6,092	.....	3,831	2,531	.....	[illegible]
1897.										
1	2,073	3,587	2,007	6,334	39,001	18,204	8,719	12,975	4,771	[illegible]
2	2,085	3,485	2,950	7,048	34,289	16,780	9,885	13,056	4,557	[illegible]
3	1,650	3,775	2,423	9,075	32,654	17,526	9,531	11,263	4,346	[illegible]
4	2,518	3,598	2,629	9,635	34,210	17,542	8,512	9,206	3,701	[illegible]
5	3,782	3,348	2,586	11,336	40,730	17,549	7,147	7,726	3,090	[illegible]
6	18,501	3,223	2,522	12,889	36,362	15,756	8,189	7,226	3,865	[illegible]
7	10,210	4,185	4,026	18,329	26,923	16,023	7,410	5,889	3,371	[illegible]
8	5,860	4,305	2,703	21,149	26,610	15,785	7,922	5,761	4,018	[illegible]
9	5,028	5,634	2,285	18,268	24,400	13,801	7,967	4,009	3,973	[illegible]
10	3,703	6,225	2,291	15,458	23,995	12,961	7,270	5,243	3,997	[illegible]
11	3,263	5,933	4,551	16,671	41,196	16,003	6,290	5,849	4,408	[illegible]
12	3,101	5,007	4,230	14,377	41,223	14,962	5,761	7,562	9,029	[illegible]
13	3,084	4,629	3,238	13,999	23,965	13,819	7,256	9,771	5,462	[illegible]
14	2,542	3,897	3,045	14,706	41,284	15,304	45,507	7,112	4,915	[illegible]
15	2,881	4,070	3,387	16,881	38,988	16,003	55,634	6,601	4,864	[illegible]
16	2,715	4,028	4,925	21,426	32,431	14,617	33,770	5,308	4,325	[illegible]
17	2,787	3,848	3,593	31,813	27,453	14,638	20,160	7,776	4,333	[illegible]
18	2,942	3,163	2,925	29,642	23,788	13,344	21,295	11,586	3,239	[illegible]
19	1,978	2,967	2,301	31,734	21,013	11,200	17,067	8,562	3,632	[illegible]
20	2,211	2,180	2,339	32,799	18,843	11,390	12,542	6,755	3,488	[illegible]
21	2,284	3,344	3,167	26,949	17,562	10,649	7,747	7,129	5,043	[illegible]
22	2,222	3,139	2,083	24,087	15,105	7,399	5,218	7,007	8,422	[illegible]
23	2,951	2,427	2,621	24,008	15,448	9,991	8,408	6,616	7,458	[illegible]
24	2,990	2,302	3,547	29,859	14,809	9,095	8,980	5,718	5,858	[illegible]
25	1,968	2,511	3,852	33,005	10,818	8,353	8,925	5,816	4,481	[illegible]
26	1,845	2,877	6,345	42,860	16,539	8,751	10,826	6,280	3,841	[illegible]
27	2,125	2,835	5,962	31,255	21,779	7,500	9,842	6,220	4,355	[illegible]
28	2,579	2,705	5,331	16,907	21,568	7,401	7,050	5,706	4,084	[illegible]
29	2,477		4,964	28,745	26,000	8,023	6,734	5,382	2,915	[illegible]
30	1,924		3,951	43,797	22,037	8,345	6,405	5,154	2,801	[illegible]
31	1,734		5,313		20,526	.....	11,707	4,364	.....	[illegible]
1898.										
1	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1899.										
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Daily discharge, in second-feet, of Kennebec River at Waterville—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
898.												
.....	2,032	3,933	17,029	45,520	15,589	7,508	3,879	4,432	5,443	4,288	7,923	2,471
.....	3,136	3,653	16,560	38,063	15,639	5,267	3,385	4,218	4,788	6,514	10,037	2,761
.....	2,905	4,387	18,928	37,354	14,611	4,326	4,189	3,940	3,581	15,310	3,672	2,464
.....	2,727	.....	19,762	33,652	16,632	5,689	3,444	3,396	3,778	11,127	2,758	2,499
.....	1,738	.....	17,711	31,767	16,962	6,715	3,204	3,555	3,247	9,229	3,723	2,076
.....	2,607	.....	27,432	.....	16,298	.....	2,832	2,857	.....	7,672	.....	2,178
899.												
.....	2,529	2,458	3,382	6,411	41,756	13,044	6,115	4,809	1,623	.....	1,390	1,456
.....	2,202	2,198	3,047	6,214	39,665	12,790	5,024	3,594	2,010	1,443	2,819	1,441
.....	2,274	2,187	3,333	6,100	36,589	10,647	5,363	4,442	567	1,665	4,093	747
.....	2,159	2,163	3,324	6,017	36,942	11,673	3,178	4,199	1,612	1,415	4,109	2,913
.....	2,452	1,580	1,960	6,207	30,922	12,264	5,258	4,498	2,070	1,969	2,995	3,567
.....	2,451	2,505	3,331	6,227	30,531	11,123	5,120	4,415	2,082	1,449	3,327	3,196
.....	2,449	2,173	3,563	6,433	30,125	10,563	5,076	5,064	2,070	1,476	3,106	2,015
.....	1,739	2,071	3,516	7,007	29,447	12,748	5,367	5,195	.....	.....	2,637	2,070
.....	2,757	2,057	3,502	7,541	26,888	12,517	3,936	4,388	2,352	1,215	2,338	1,737
.....	2,513	2,152	3,428	9,001	24,803	12,506	5,142	4,128	246	940	2,119	.....
.....	2,400	2,141	3,357	9,650	22,132	10,738	5,123	4,101	2,635	774	1,698	1,393
.....	2,386	2,244	2,302	9,405	20,229	10,278	4,866	3,954	2,067	1,784	.....	1,160
.....	2,404	2,348	3,353	11,181	18,697	6,039	5,100	2,699	2,340	1,968	1,488	2,022
.....	2,436	1,964	3,423	19,700	19,643	7,030	5,950	3,964	2,370	1,391	1,970	5,223
.....	1,678	1,844	3,624	23,106	14,886	6,739	5,078	3,538	2,257	492	2,017	4,410
.....	2,731	2,392	3,773	38,826	15,099	7,557	4,043	3,213	1,261	1,378	2,053	4,621
.....	2,439	2,434	3,501	30,532	17,307	5,913	4,866	3,007	1,298	1,667	1,823	1,861
.....	2,631	2,727	3,253	30,312	15,073	6,807	5,232	3,321	1,416	1,366	1,739	2,695
.....	2,434	2,198	1,960	37,096	15,071	7,290	4,948	2,643	2,005	1,096	.....	2,027
.....	2,629	2,915	3,320	41,565	15,684	6,483	4,880	1,242	2,362	1,377	1,718	2,611
.....	2,440	2,734	3,080	34,540	16,262	7,101	5,499	2,748	2,006	1,120	2,317	1,878
.....	2,094	2,744	2,778	30,286	18,287	7,317	6,367	3,377	2,351	.....	1,748	2,340
.....	2,709	2,451	2,711	39,550	17,271	7,319	5,688	2,956	2,348	1,408	2,085	2,617
.....	2,154	2,745	2,837	45,724	15,900	7,516	6,509	2,534	1,073	1,334	2,035	2,068
.....	2,435	2,929	2,770	41,739	15,925	5,673	5,837	2,180	2,031	1,104	2,028	.....
.....	2,450	1,420	2,030	43,139	11,480	7,301	5,916	2,158	1,761	995	.....	.....
.....	2,454	3,039	2,786	45,795	12,567	7,315	5,502	1,089	1,466	1,149	1,413	2,323
.....	2,434	3,362	2,740	39,943	12,303	6,880	5,649	2,288	2,046	1,121	1,743	2,330
.....	1,245	.....	2,998	41,584	13,064	7,038	4,170	2,203	1,951	406	1,744	1,821
.....	2,513	.....	3,962	39,300	13,035	6,445	2,500	2,065	2,091	1,104	.....	1,474
.....	2,453	.....	6,820	.....	12,823	.....	4,087	2,354	.....	1,086	.....	.....
900.												
.....	1,463	7,117	15,468	8,792	22,830	12,115	4,849	4,910	4,238	2,859	2,307	6,540
.....	1,565	3,606	13,353	8,381	27,905	12,782	8,232	5,149	1,635	3,337	2,357	4,394
.....	1,604	3,628	9,656	9,338	28,823	15,730	7,520	5,525	3,191	3,134	2,293	6,146
.....	1,653	.....	11,445	14,047	52,268	25,091	2,763	5,601	3,180	2,876	1,502	5,968
.....	1,193	3,166	6,544	15,927	48,843	19,591	6,715	4,431	2,905	2,565	1,660	4,640
.....	1,452	3,150	6,240	15,544	39,585	16,103	6,255	5,357	2,913	2,168	2,260	4,583
.....	1,304	3,188	9,323	19,353	34,551	14,088	6,271	4,708	2,865	859	1,604	4,506
.....	2,324	3,303	4,913	27,072	28,889	12,792	4,799	4,597	2,908	3,457	1,630	4,701
.....	2,000	2,925	4,947	24,219	23,561	10,930	6,465	4,573	2,276	3,715	3,819	3,548
.....	1,998	3,114	4,927	19,765	28,628	10,495	6,501	4,758	2,330	3,715	17,580	4,498
.....	1,751	1,615	4,373	17,053	25,277	10,083	5,767	4,462	2,871	4,051	11,521	2,978
.....	1,711	2,933	4,950	20,560	22,411	10,148	4,984	2,627	2,865	4,106	13,301	3,504
.....	1,009	12,148	4,932	25,463	20,804	9,661	12,281	4,651	2,560	4,003	10,314	3,851
.....	696	15,696	4,799	27,373	18,378	10,168	9,601	4,716	2,851	.....	8,564	4,078
.....	1,712	21,761	5,051	26,429	22,307	7,707	6,262	4,450	2,826	2,580	5,839	4,101
.....	1,996	19,766	10,516	31,224	29,793	9,141	7,018	4,750	2,426	3,993	4,877	3,080
.....	1,755	15,073	7,479	32,034	29,945	7,256	5,112	4,834	3,130	3,993	3,706	3,958
.....	1,748	11,996	12,670	35,155	31,845	7,808	6,017	4,624	3,147	4,190	6,533	4,068
.....	2,064	5,871	20,538	42,557	40,265	7,308	5,652	3,075	2,776	3,989	5,079	3,505
.....	1,792	7,090	12,562	60,541	48,460	5,866	6,057	4,547	2,602	3,720	5,215	3,809
.....	656	6,978	12,448	62,291	44,162	6,402	5,678	4,072	3,044	2,392	8,107	3,799
.....	2,060	6,123	12,412	55,863	35,000	6,651	4,386	3,203	2,776	3,164	6,360	4,109
.....	4,045	5,308	11,361	51,180	25,403	6,613	5,253	4,029	.....	3,185	12,471	1,895
.....	3,748	4,117	10,742	44,066	23,333	5,015	4,923	3,649	3,137	2,621	8,620	3,880
.....	3,697	18,833	9,792	39,913	21,682	6,669	4,737	.....	2,887	2,902	7,886	3,196
.....	3,684	13,387	9,440	33,353	18,907	5,066	5,403	1,016	2,563	2,624	7,000	4,311
.....	3,609	23 971	8,925	27,800	17,467	5,803	4,857	3,169	2,575	2,373	7,320	4,498
.....	3,007	18,375	8,604	23,905	15,469	7,679	4,872	3,501	2,568	1,520	9,693	4,299
.....	6,851	.....	8,391	21,793	19,171	7,189	2,344	3,629	3,169	2,902	5,214	4,035
.....	4,311	.....	8,410	14,688	16,301	9,043	4,231	3,147	2,197	2,623	6,660	2,468
.....	5,399	.....	8,498	.....	14,113	.....	3,725	3,454	.....	2,338	.....	4,050

Daily discharge, in second-feet, of Kennebec River at Waterville—

Day	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	11,040	29,000	5,140	9,080	5,480	1,470	
2	15,280	30,570	6,540	7,370	5,250	4,760	
3	19,520	29,620	8,700	7,330	4,810	4,250	
4	25,040	29,080	12,930	4,020	2,410	3,910	
5	34,400	28,350	11,340	7,940	3,880	3,040	
6	37,980	21,340	9,980	7,330	3,170	2,68	
7	42,370	13,300	9,110	5,110	3,250	3,04	
8	37,420	11,400	8,560	5,130	3,820	1,14	
9	37,780	15,780	15,250	6,020	3,180	2,87	
10	40,780	12,530	13,900	5,770	5,040	3,12	
11	33,410	10,330	10,080	5,770	3,240	2,7	
12	31,240	22,800	20,120	5,470	5,040	3,0	
13	35,610	23,110	[illegible]	5,440	5,920	3,6	
14	31,270	21,770	[illegible]	3,310	3,410	3,7	
15	32,440	18,120	7,470	4,840	5,010	1,7	
16	31,220	14,230	5,630	4,600	3,840	3,3	
17	24,210	14,210	[illegible]	4,470	5,040	3,0	
18	29,820	12,110	[illegible]	4,400	4,080	2,8	
19	29,170	10,450	[illegible]	4,450	4,700	1,9	
20	25,040	14,360	6,630	4,840	4,060	2,5	
21	28,340	11,930	6,220	4,010	3,960	2,1	
22	43,220	[illegible]	[illegible]	4,220	3,650	[illegible]	
23	37,370	9,840	5,630	3,940	3,120	3,1	
24	37,960	7,940	5,220	3,480	3,840	3,1	
25	42,200	7,380	6,020	3,400	3,360	2,9	
26	44,710	6,060	[illegible]	3,720	4,110	2,9	
27	42,200	9,080	[illegible]	3,810	3,960	3,1	
28	34,920	8,240	[illegible]	2,810	2,760	3,1	
29	34,740	6,080	[illegible]	4,310	1,840	[illegible]	
30	[illegible]	6,440	[illegible]	4,320	1,840	3,0	
31	[illegible]	[illegible]	[illegible]	5,740	1,820	[illegible]	
1	11,790	17,850	34,410	15,370	12,200	4,990	3,[illegible]
2	13,120	[illegible]	28,840	15,350	12,070	5,370	4,[illegible]
3	[illegible]	[illegible]	28,840	13,070	13,200	4,160	4,0
4	[illegible]	[illegible]	26,340	12,740	10,310	12,010	3,[illegible]
5	[illegible]	[illegible]	25,220	10,730	17,840	10,980	7,480	3,[illegible]
6	[illegible]	[illegible]	17,210	19,750			
7	[illegible]	[illegible]	17,840	18,140	10,880	6,480	4,0
8	[illegible]	[illegible]	21,220	16,280	10,470	5,320	1,[illegible]
9	[illegible]	[illegible]	20,730	20,140	9,670	5,130	3,[illegible]
10	[illegible]	[illegible]	17,520	24,350	8,810	7,240	4,0
11	[illegible]	[illegible]	15,730	20,380	8,910	4,120	4,0
12	[illegible]	[illegible]	[illegible]	[illegible]	9,510	[illegible]	
13	[illegible]	[illegible]	[illegible]	[illegible]	10,410	5,080	[illegible]
14	[illegible]	[illegible]	[illegible]	14,700	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	13,040	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	11,700	6,440	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	6,940	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	11,210	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	11,340	7,340	3,920	[illegible]
20	[illegible]	[illegible]	[illegible]	11,300	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	10,670	6,920	3,740	[illegible]
22	[illegible]	[illegible]	[illegible]	10,530	6,940	3,440	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	5,740	2,640	[illegible]
24	[illegible]	[illegible]	9,610	9,710	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	6,740	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	7,010	2,300	[illegible]
27	[illegible]	[illegible]	[illegible]	13,100	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	10,020	6,940	3,320	[illegible]
29	[illegible]	[illegible]	[illegible]	10,170	6,460	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	6,230	2,950	[illegible]
31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3,070	[illegible]
1	23,180	11,910	13,590	10,300	[illegible]	3,250	[illegible]
2	18,220	13,450	24,000	11,940	4,870	[illegible]	[illegible]
3	13,950	[illegible]	[illegible]	[illegible]	4,300	6,590	3,8
4	[illegible]	[illegible]	[illegible]	23,870	[illegible]	4,080	[illegible]
5	[illegible]	[illegible]	[illegible]	17,370	5,100	4,130	[illegible]
6	[illegible]	[illegible]	[illegible]	12,930	5,170	4,150	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	4,950	4,040	[illegible]
8	17,020	[illegible]	12,850	[illegible]	4,950	1,800	[illegible]

Daily discharge, in second-feet, of Kennebec River at Waterville—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1898.												
26	2,032	3,933	17,029	45,520	15,589	7,508	3,879	4,432	5,443	4,288	7,923	2,471
27	3,136	3,653	16,560	38,063	15,639	5,267	3,385	4,218	4,788	6,514	10,037	2,761
28	2,905	4,387	18,928	37,354	14,611	4,326	4,189	3,940	3,581	15,319	3,672	2,464
29	2,727	.....	19,762	33,652	16,632	5,689	3,444	3,396	3,778	11,127	2,758	2,499
30	1,738	.....	17,711	31,767	16,962	6,715	3,204	3,555	3,247	9,229	3,723	2,076
31	2,807	.....	27,432	.....	16,298	.....	2,832	2,857	.....	7,672	.....	2,178
1899.												
1	2,529	2,458	3,382	6,411	41,756	13,044	6,115	4,809	1,623	.....	1,390	1,456
2	2,202	2,198	3,047	6,214	39,665	12,790	5,024	3,594	2,010	1,443	2,819	1,441
3	2,274	2,187	3,333	6,100	36,589	10,647	5,303	4,442	567	1,665	4,093	747
4	2,159	2,163	3,324	6,017	36,942	11,673	3,178	4,199	1,612	1,415	4,109	2,913
5	2,452	1,580	1,960	6,207	30,922	12,264	5,258	4,498	2,070	1,969	2,995	3,567
6	2,451	2,505	3,331	6,227	30,531	11,123	5,120	4,415	2,082	1,449	3,327	3,196
7	2,449	2,173	3,563	6,433	30,125	10,563	5,076	5,064	2,070	1,476	3,106	2,015
8	1,739	2,071	3,516	7,007	29,447	12,748	5,367	5,195	.....	.....	2,637	2,070
9	2,757	2,057	3,502	7,541	26,888	12,517	3,936	4,388	2,352	1,215	2,338	1,737
10	2,513	2,152	3,428	9,001	24,803	12,506	5,142	4,128	246	940	2,119	.....
11	2,400	2,141	3,357	9,650	22,132	10,738	5,123	4,101	2,635	774	1,698	1,393
12	2,386	2,244	2,302	9,405	20,229	10,278	4,896	3,954	2,067	1,784	.....	1,160
13	2,404	2,348	3,353	11,181	18,697	6,039	5,100	2,699	2,340	1,908	1,488	2,022
14	2,436	1,964	3,423	19,700	19,643	7,030	5,950	3,964	2,370	1,391	1,970	5,223
15	1,678	1,844	3,624	23,106	14,886	6,739	5,078	3,538	2,257	492	2,017	4,410
16	2,731	2,392	3,773	38,826	15,099	7,557	4,043	3,213	1,261	1,378	2,053	4,621
17	2,439	2,434	3,501	30,532	17,307	5,913	4,806	3,007	1,298	1,667	1,823	1,861
18	2,631	2,727	3,253	30,312	15,073	6,807	5,232	3,321	1,416	1,366	1,739	2,095
19	2,434	2,198	1,960	37,096	15,071	7,290	4,948	2,643	2,005	1,096	.....	2,027
20	2,629	2,915	3,320	41,565	15,684	6,483	4,880	1,242	2,302	1,377	1,718	2,611
21	2,440	2,734	3,080	34,540	16,262	7,101	5,499	2,748	2,006	1,120	2,317	1,878
22	2,094	2,744	2,778	30,286	18,287	7,317	6,367	3,377	2,351	.....	1,748	2,340
23	2,709	2,451	2,711	30,530	17,271	7,319	5,688	2,955	2,348	1,408	2,085	2,617
24	2,154	2,745	2,837	45,724	15,900	7,516	6,509	2,534	1,073	1,334	2,035	2,068
25	2,435	2,929	2,770	41,730	15,925	5,673	5,837	2,180	2,031	1,104	2,028	.....
26	2,450	1,420	2,030	43,139	11,490	7,301	5,916	2,158	1,761	935	.....	.....
27	2,454	3,039	2,786	45,795	12,567	7,315	5,502	1,089	1,466	1,149	1,413	2,323
28	2,434	3,362	2,740	39,043	12,303	6,880	5,649	2,288	2,046	1,121	1,743	2,330
29	1,245	.....	2,998	41,584	13,064	7,038	4,170	2,203	1,951	406	1,744	1,821
30	2,513	.....	3,962	39,300	13,035	6,445	2,500	2,065	2,091	1,104	.....	1,474
31	2,453	.....	6,820	.....	12,823	.....	4,087	2,354	.....	1,086	.....	.....
1900.												
1	1,463	7,117	15,468	8,792	22,830	12,115	4,849	4,910	4,238	2,859	2,307	6,540
2	1,565	3,606	13,353	8,381	27,905	12,782	8,232	5,149	1,635	3,337	2,357	4,394
3	1,604	3,628	9,656	9,336	28,823	15,730	7,520	5,525	3,191	3,134	2,293	6,146
4	1,653	.....	11,445	14,047	52,268	25,091	2,763	5,601	3,180	2,876	1,502	5,968
5	1,193	3,166	6,544	15,927	48,843	19,591	6,715	4,431	2,905	2,565	1,660	4,640
6	1,452	3,159	6,240	15,544	39,585	16,103	6,255	5,357	2,913	2,168	2,260	4,583
7	1,304	3,188	9,323	19,353	34,551	14,088	6,271	4,708	2,865	859	1,604	4,506
8	2,324	3,303	4,913	27,072	28,889	12,792	4,799	4,597	2,908	3,457	1,630	4,701
9	2,000	2,925	4,947	24,219	23,561	10,930	6,465	4,573	2,276	3,715	3,819	3,548
10	1,998	3,114	4,927	19,765	28,628	10,495	6,501	4,758	2,330	3,715	17,580	4,498
11	1,751	1,615	4,373	17,053	25,277	10,083	5,767	4,462	2,871	4,051	11,521	2,978
12	1,711	2,933	4,950	20,560	22,411	10,148	4,984	2,627	2,865	4,106	13,301	3,504
13	1,009	12,148	4,932	25,463	20,804	9,661	12,281	4,651	2,560	4,003	10,314	3,851
14	696	15,096	4,799	27,373	18,378	10,168	9,601	4,716	2,851	.....	8,564	4,078
15	1,712	21,761	5,051	26,429	22,307	7,707	6,262	4,450	2,826	2,590	5,839	4,101
16	1,996	19,766	10,516	31,224	29,793	9,141	7,018	4,750	2,426	3,993	4,877	3,080
17	1,755	15,073	7,479	32,034	29,945	7,256	5,112	4,834	3,130	3,993	3,706	3,958
18	1,748	11,996	12,670	35,155	31,845	7,808	6,017	4,624	3,147	4,190	6,533	4,068
19	2,064	5,871	20,538	42,557	40,265	7,308	5,652	3,075	2,776	3,989	5,079	3,505
20	1,792	7,090	12,562	60,541	48,440	5,866	6,057	4,547	2,602	3,720	5,215	3,809
21	656	6,978	12,448	62,201	44,162	6,402	5,678	4,072	3,044	2,392	8,107	3,799
22	2,040	6,123	12,412	55,863	35,040	6,651	4,386	3,203	2,776	3,164	6,360	4,109
23	4,045	5,308	11,361	51,180	25,403	6,613	5,253	4,029	.....	3,185	12,471	1,895
24	3,748	4,117	10,742	44,066	23,333	5,015	4,923	3,649	3,137	2,621	8,620	3,880
25	3,697	18,833	9,792	39,913	21,682	6,769	4,737	.....	2,887	2,902	7,886	3,196
26	3,684	13,387	9,460	33,353	18,907	5,066	5,403	1,016	2,563	2,624	7,000	4,311
27	3,609	23 971	8,925	27,800	17,467	5,803	4,857	3,169	2,575	2,373	7,320	4,498
28	3,007	18,375	8,604	23,905	15,469	7,679	4,872	3,501	2,568	1,520	9,083	4,299
29	6,851	.....	*8,391*	*21,793*	*19,171*	7,189	2,344	3,629	3,169	2,902	5,234	4,035
30	*4,311*	.....	*8,410*	*14,688*	*16,301*	9,043	4,231	3,147	2,197	2,623	6,660	2,468
31	*5,390*	.....	*8,498*	.....	*14,113*	.....	3,725	3,454	.....	2,338	.....	4,050

Daily discharge, in second-feet, of Kennebec River at Waterville [Drainage area

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	N
1905.											
1	2,116	3,366	2,645	32,125	10,058	6,501	5,275	5,114	3,077	2,64	
2	2,256	3,125	2,532	22,278	13,393	7,755	5,040	4,198	2,42	2,35	
3	3,421	3,422	2,366	16,278	8,680	6,597	5,470	4,401	100	2,45	
4	2,847	2,868	2,521	14,471	7,113	6,102	8,591	4,018	3,30	2,28	
5	2,737	2,123	714	10,854	12,907	8,371	7,554	3,429	3,912	1,82	
6	2,545	3,225	2,815	11,303	18,324	7,113	6,303	2,630	4,003	2,36	
7	2,872	2,956	2,202	25,578	11,542	7,480	5,962	3,962	4,350	2,14	
8	2,004	2,569	2,431	19,498	10,545	5,123	5,422	2,940	4,05	100	
9	3,009	2,356	2,257	15,715	10,425	6,815	3,434	3,133	3,004	1,87	
10	3,012	2,484	2,555	12,342	10,923	6,020	4,057	3,307	2,718	2,20	
11	3,650	2,553	2,541	12,304	11,251	6,119	4,836	2,810	3,26	2,22	
12	4,182	1,859	2,278	15,200	9,696	6,780	5,024	3,048	3,071	1,87	
13	3,015	3,158	2,855	15,780	8,440	7,333	5,015	100	3,055	1,82	
14	3,023	2,475	2,540	20,954	9,109	9,251	4,948	3,004	2,83	2,08	
15	2,317	2,568	2,273	11,928	9,550	8,493	4,954	3,036	2,90	741	
16	3,642	2,548	2,208	14,340	8,099	7,386	6,805	3,310	2,98	2,47	
17	3,108	2,570	2,245	11,456	10,196	6,071	5,025	3,315	1,85	2,45	
18	3,125	2,546	2,247	12,690	11,441	5,548	4,298	3,8 2	2,46	2,42	
19	3,103	1,842	1,553	7,095	14,315	5,981	4,676	2,819	3,04	2,05	
20	3,099	3,033	2,561	6,291	14,279	6,678	5,002	2,642	4,20	1,87	
21	3,324	2,547	2,615	7,486	9,711	6,108	5,301	3,653	2,95	1,85	
22	2,286	2,541	2,849	19,164	8,788	7,433	3,909	3,344	3,16	100	
23	3,654	2,545	3,384	12,931	10,174	6,678	2,814	3,372	3,67	1,12	
24	2,164	2,520	3,447	11,205	11,260	6,325	3,997	2,998	1,370	1,55	
25	2,825	2,811	3,701	7,878	8,403	5,109	3,648	2,022	2,630	2,37	
26	2,849	1,300	3,349	8,294	11,298	6,017	3,372	2,955	3,169	1,80	
27	3,145	3,119	13,250	7,081	10,583	6,633	3,828	1,578	2,802	1,87	
28	3,130	2,520	15,215	8,881	10,120	6,730	3,408	3,635	2,30	1,69	
29	1,851		20,950	8,901	8,241	6,672	3,473	3,047	2,56	90	
30	3,100		21,365	6,103	8,153	5,845	1,491	3,051	142	1,67	
31	3,150		20,230	.....	8,202	.....	3,986	3,161	.....	2,484	
1906.											
1	2,150	3,702	2,310	4,223	20,350	16,920	7,574	5,240	3,035	1,284	
2	2,139	3,701	2,555	4,170	24,520	14,430	7,288	4,753	3,041	1,284	
3	3,004	3,187	2,530	4,055	25,210	15,800	7,829	4,552	4,089	2,105	
4	2,992	1,728	1,344	3,995	26,389	16,380	6,500	4,295	3,647	1,842	
5	187	2,068	2,068	1,340	27,639	14,770	7,557	3,457	3,040	1,790	
6	2,459	3,624	2,700	6,743	24,080	14,920	7,768	4,630	3,719	1,810	
7	2,433	3,406	2,660	7,807	23,770	21,450	7,626	4,219	2,651	873	
8	2,748	2,208	2,777	6,924	23,100	20,350	7,133	3,657	3,419	1,806	
9	2,746	1,278	2,078	7,270	20,300	21,030	7,384	3,861	1,812	1,809	
10	2,746	1,278	1,124	7,286	22,770	18,150	6,930	4,884	3,481	2,174	
11	1,351	1,278	1,224	6,021	31,470	18,510	7,005	4,186	3,304	2,178	
12	2,153	2,745	2,770	5,855	27,770	15,720	7,412	2,159	2,989	2,152	
13	2,152	2,061	2,849	6,311	20,580	19,130	8,801	3,377	1,850	2,317	
14	2,152	2,078	2,000	6,067	22,580	14,710	8,122	3,326	3,45	2,145	
15	1,952	2,068	2,241	17,180	22,020	12,920	7,218	2,993	2,959	3,853	
16	214	2,024	2,700	20,300	18,650	11,240	6,267	3,036	1,195	2,710	
17	2,145	2,120	1,744	17,080	19,060	10,810	5,285	3,350	2,08	2,402	
18	2,051	1,109	588	21,120	21,240	5,326	6,080	3,009	1,740	1,98	
19	2,150	2,589	2,561	23,050	21,180	6,479	5,928	2,386	2,114	1,95	
20	2,150	2,676	2,200	23,050	23,070	8,127	5,557	3,761	2,863	2,257	
21	1,152	2,459	1,967	28,840	20,090	7,337	5,303	3,081	2,421	1,817	
22	2,848	2,548	2,788	21,510	19,080	7,378	4,357	2,783	2,131	3,050	
23	3,011	2,456	1,988	22,930	18,110	8,803	5,515	3,010	981	3,052	
24	2,171	2,546	1,972	23,970	17,080	12,630	5,533	3,547	2,088	3,109	
25	2,200	1,205	916	22,050	14,150	11,280	5,905	3,280	1,788	3,025	
26	2,200	2,337	2,004	21,220	16,840	8,161	5,286	2,291	2,081	3,301	
27	2,201	2,551	1,927	19,240	20,730	5,374	4,851	3,401	1,812	3,078	
28	2,200	2,856	2,475	17,300	21,230	9,272	4,666	3,445	2,071	3,078	
29	2,057		2,111	19,230	21,240	7,504	3,068	3,220	1,758	3,321	
30	2,001		1,208	20,540	20,080	7,067	3,815	4,909	588	3,078	
31	2,000		2,040	.....	19,080	.....	5,113	4,048	.....	3,040	

Monthly discharge of Kennebec River at Waterville.

[Drainage area 4,270 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1893.					
y 12–31	5,000	1,900	2,650	0.621	0.46
ry	3,000	2,100	2,350	.550	.57
	11,300	2,300	4,180	.980	1.13
	19,800	3,600	11,660	2.73	3.05
	83,500	13,600	30,520	7.14	8.23
	23,500	11,000	15,290	3.58	3.99
	11,230	2,240	5,770	1.35	1.56
	2,430	1,940	2,270	.531	.61
ber	2,680	1,710	2,040	.478	.53
r	4,000	1,440	2,330	.545	.63
ber	3,980	1,980	2,230	.522	.58
er	2,780	1,440	1,580	.370	.43
he year	83,500	1,440	6,906	1.62	21.78
1894.					
r	1,910	1,470	1,640	.384	.44
ry	1,910	1,740	1,780	.417	.43
	6,660	1,740	4,020	.940	1.08
	35,280	4,370	14,680	3.43	3.83
	15,650	5,840	9,570	2.24	2.58
	12,930	3,710	7,790	1.82	2.03
	10,020	3,345	5,720	1.34	1.54
	3,305	2,294	2,970	.696	.80
ber	12,100	467	2,740	.641	.72
r	9,040	1,655	3,750	.878	1.01
ber	10,510	1,440	3,760	.881	.98
er	2,600	904	1,930	.452	.52
he year	35,280	467	5,030	1.18	15.97
1895.					
r	2,510	1,135	2,040	.477	.55
ry	2,440	579	1,800	.421	.44
	2,770	1,252	2,000	.467	.54
	86,200	2,176	23,930	5.60	6.25
	16,170	4,868	9,580	2.24	2.58
	9,820	4,497	6,430	1.50	1.67
	5,040	2,096	3,520	.824	.95
	5,090	857	2,690	.630	.73
ber	2,870	1,104	1,780	.417	.47
r	1,590	1,081	1,250	.292	.34
ber	15,900	1,081	5,610	1.31	1.46
er	26,670	1,105	6,030	1.41	1.62
he year	86,200	579	5,555	1.30	17.53
1896.					
r	21,880	1,568	4,300	1.01	1.16
ry	4,630	1,202	2,830	.663	.72
	111,250	3,239	13,140	3.07	3.54
	74,470	4,998	27,400	6.42	7.16
	30,880	3,192	17,050	3.99	4.60
	11,000	3,855	5,520	1.29	1.44
	11,680	3,335	5,330	1.25	1.44
	4,740	1,025	3,150	.738	.85
ber	7,980	1,733	3,410	.799	.89
r	8,960	2,016	3,660	.857	.99
ber	29,860	3,238	9,060	2.12	2.36
er	8,050	1,489	2,750	.643	.74
he year	111,250	1,292	8,130	1.90	25.89
1897.					
r	18,504	1,650	3,587	.839	.97
ry	6,225	2,302	3,705	.868	.90
	6,345	2,007	3,970	.929	1.07
	66,907	6,334	25,385	5.94	6.63
	41,284	10,818	26,942	6.30	7.26
	18,204	7,399	12,970	3.04	3.39
	55,634	5,218	13,115	3.07	3.54
	13,656	4,000	7,298	1.71	1.97
ber	9,689	2,801	4,595	1.07	1.19
r	6,323	967	2,635	.617	.71
ber	13,390	1,889	5,702	1.33	1.48
er	14,005	2,541	5,331	1.25	1.44
ie year	66,907	967	9,588	2.25	30.55

Monthly discharge of Kennebec River at Waterville—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1898.					
January	5,434	1,738	3,213	0.752	[illegible]
February	4,387	2,133	3,402	.797	[illegible]
March	27,432	4,094	11,287	2.64	[illegible]
April	52,119	6,563	29,833	6.98	[illegible]
May	39,372	14,611	25,120	5.88	[illegible]
June	14,341	4,326	9,983	2.34	[illegible]
July	5,464	1,745	3,908	.917	[illegible]
August	4,432	913	3,133	.733	[illegible]
September	5,443	1,437	2,618	.613	[illegible]
October	15,319	961	4,047	.947	[illegible]
November	10,037	2,758	5,178	1.21	[illegible]
December	3,752	1,723	2,620	.613	[illegible]
The year	52,119	913	8,695	2.03	[illegible]
1899.					
January	2,757	1,245	2,357	.552	[illegible]
February	3,362	1,420	2,363	.553	[illegible]
March	6,820	1,960	3,218	.754	[illegible]
April	45,795	6,017	24,006	5.62	[illegible]
May	41,756	11,480	21,303	4.98	[illegible]
June	13,044	5,673	8,821	2.06	[illegible]
July	6,509	2,500	5,077	1.19	[illegible]
August	5,195	1,089	3,302	.773	[illegible]
September	2,635	246	1,854	.434	[illegible]
October	1,969	406	1,274	.298	[illegible]
November	4,109	1,390	2,252	.527	[illegible]
December	5,223	747	2,741	.641	[illegible]
The year	45,724	246	6,547	1.53	[illegible]
1900.					
January	6,851	656	2,384	.557	[illegible]
February	23,971	1,615	9,050	2.12	[illegible]
March	20,538	4,373	9,153	2.14	[illegible]
April	62,291	8,381	28,473	6.66	[illegible]
May	52,208	14,113	28,272	6.62	[illegible]
June	25,091	5,015	10,033	2.35	[illegible]
July	12,281	2,344	5,791	1.35	[illegible]
August	5,601	1,016	4,173	.977	[illegible]
September	4,238	1,635	2,807	.657	[illegible]
October	4,190	859	3,065	.718	[illegible]
November	17,580	1,502	6,376	1.49	[illegible]
December	6,540	1,895	4,096	.959	[illegible]
The year	62,291	656	9,473	2.22	[illegible]
1901.					
January	4,040	1,880	3,176	.743	[illegible]
February	3,000	1,430	2,489	.583	[illegible]
March	13,340	700	4,805	1.13	[illegible]
April	76,590	11,600	41,130	9.63	[illegible]
May	30,570	5,140	15,169	3.55	[illegible]
June	15,250	5,140	8,235	1.93	[illegible]
July	9,080	2,810	5,122	1.20	[illegible]
August	6,480	1,840	4,178	.979	[illegible]
September	4,760	750	2,821	.660	[illegible]
October	6,680	670	2,925	.685	[illegible]
November	3,710	480	2,405	.563	[illegible]
December	151,000	170	11,910	2.79	[illegible]
The year	151,000	170	8,697	2.04	[illegible]
1902.					
January	10,510	900	3,856	.903	[illegible]
February	4,840	2,100	3,800	.889	[illegible]
March	57,970	11,790	28,768	6.73	[illegible]
April	47,870	13,430	22,191	5.19	[illegible]
May	34,410	5,560	16,873	3.95	[illegible]
June	33,940	8,400	15,260	3.57	[illegible]
July	13,200	4,500	7,840	1.83	[illegible]
August	12,670	1,860	5,057	1.18	[illegible]
September	7,570	1,590	4,218	.988	[illegible]
October	24,980	1,750	5,255	1.23	[illegible]
November	8,020	3,040	4,517	1.06	[illegible]
December	6,930	1,020	4,346	1.02	[illegible]
The year	57,970	900	10,165	2.38	[illegible]

Monthly discharge of Kennebec River at Waterville—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
	6,577	2,061	4,011	0.938	1.08
	4,486	2,003	3,980	.932	.97
	35,732	6,069	19,395	4.54	5.23
	23,662	5,531	16,465	3.85	4.30
	12,725	2,098	7,255	1.70	1.96
	30,050	2,397	6,691	1.57	1.75
	9,018	2,445	5,227	1.22	1.40
	5,624	672	3,875	.907	1.04
r	3,697	115	2,503	.586	.65
	3,984	100	1,922	.450	.52
r	2,845	115	1,468	.344	.38
	3,825	100	1,389	.325	.37
year	35,732	100	6,182	1.45	19.06
1904.					
	1,909	100	975	.228	.26
	1,891	100	921	.216	.23
	11,380	100	3,786	.886	1.02
	36,110	6,770	14,960	3.50	3.90
	37,840	8,277	20,716	4.85	5.59
	14,460	4,670	8,286	1.94	2.16
	8,263	2,941	5,360	1.25	1.44
	6,720	2,950	4,705	1.10	1.27
r	8,111	2,610	4,283	1.00	1.12
	10,460	2,768	4,704	1.10	1.27
r	4,365	658	3,371	.789	.88
	3,462	100	2,756	.645	.74
year	36,110	100	6,235	1.46	19.89
1905.					
	4,182	1,831	3,082	.721	.83
	3,422	1,200	2,630	.615	.64
	26,230	714	5,249	1.23	1.42
	32,120	6,291	13,500	3.16	3.52
	18,320	7,113	10,520	2.46	2.83
	9,251	5,109	6,699	1.57	1.75
	8,591	1,491	4,668	1.09	1.26
	5,114	100	3,198	.748	.86
r	4,603	100	2,974	.696	.78
	2,478	100	1,767	.413	.48
r	3,452	100	2,306	.540	.60
	3,932	914	2,063	.483	.56
year	32,120	100	4,888	1.14	15.52
1906.					
	8,208	633	3,212	.752	.87
	3,792	699	2,279	.534	.56
	5,016	906	2,290	.536	.62
	39,390	3,965	17,200	4.03	4.50
	34,370	14,430	22,290	5.22	6.02
	21,450	5,326	12,790	3.00	3.35
	8,801	3,668	6,309	1.48	1.71
	5,240	2,159	3,665	.858	.99
r	4,089	588	2,530	.593	.66
	9,178	873	3,797	.889	1.02
r	4,734	2,091	3,428	.803	.90
	4,105	1,075	2,559	.597	.69
year	39,390	588	6,862	1.61	21.89

MOOSE RIVER NEAR ROCKWOOD.

station was established September 7, 1902, by N. C. Grover. cated 4 miles west of Kineo, near the village of Rockwood and from the mouth of the river. It is reached by steamer or row- om Kineo. Water is stored by dams at the outlets of several lakes and ponds in the basin above, but all of such stored water l for log driving. The stage of the river changes very slowly

after the end of the log-driving season. Practically all of the land areas in this basin are in forest.

The channel is straight above and below the station and is about 220 feet wide at ordinary stages. The banks are high and rocky; the bed of the stream is rocky and permanent; the current is swift at high and medium at low stages.

Discharge measurements are made from a car suspended from a steel cable or by wading at low stages a short distance downstream. The initial point for soundings is on the right bank 1 foot from a birch tree, to which the cable and tag line are fastened.

Gage readings are made twice each day by Peter Callaghan. A standard chain gage is attached to trees on the bank, and at different times temporary staff gages have been placed in the vicinity of the chain gage for use during low water and in winter. All gages are referred to the following bench mark: A copper bolt in a bowlder 8 feet from the corner of the house of Peter Callaghan; elevation, 14.58 feet above the datum of the gages.

Values of monthly means, as given below, for this station are considered to be within 5 per cent of the true flow. Daily discharges are liable to somewhat larger errors, particularly below gage height 1.7 feet.

A view of this station and gage is shown in Pl. II, *A* (p. 26).

Discharge measurements of Moose River near Rockwood.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec.-ft.*
September 7	2.40	385	May 21	6.41	3,460
November 23	3.90	1,168	July 10	3.58	950
1903.			August 14[a]	2.02	280
June 7	2.73	498	November 2[b]	1.56	111
September 15	1.85	198	November 10[b]	1.72	161
November 21	1.69	176	1906.		
			November 13	3.25	765

[a] By wading 200 feet below cable. [b] By wading 150 feet below cable.

Daily gage height, in feet, of Moose River near Rockwood.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1902.[a]					1902.				
1		3.6	4.6	3.5	17	2.95	3.3	3.9	2.8
2		3.6	4.6	3.5	18	2.9	3.25	3.9	2.8
3		3.5	4.5	3.5	19	2.9	3.2	3.9	2.8
4	2.5	3.45	4.4	3.4	20	3.1	3.3	3.9	2.8
5	2.4	3.4	4.35	3.4	21	3.4	3.4	3.9	2.8
6	2.4	3.4	4.3	3.4	22	3.7	3.45	3.9	2.85
7	2.4	3.4	4.2	3.35	23	3.8	3.5	3.9	2.9
8	2.4	3.5	4.2	3.25	24	3.8	3.5	3.9	2.9
9	2.4	3.5	4.05	3.15	25	3.8	3.5	3.85	2.9
10	2.5	3.45	4.0	3.1	26	3.75	3.45	3.8	2.9
11	2.5	3.4	3.9	3.0	27	3.7	3.4	3.75	2.9
12	2.6	3.4	3.85	2.95	28	3.7	3.5	3.7	2.9
13	2.6	3.3	3.8	2.9	29	3.65	4.05	3.65	2.9
14	2.75	3.3	3.8	2.9	30	3.6	4.45	3.6	2.9
15	2.85	3.3	3.8	2.8	31		4.6		2.9
16	2.9	3.3	3.8	2.8					

[a] A number of 1902 gage heights, as previously published, were slightly in error and have been corrected in the above table to agree with observer's original record.

Daily gage height, in feet, of Moose River near Rockwood—Continued.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
a												
	b 2.8			6.95	5.65			2.95	2.2	1.5	1.5	1.6
	2.7			6.65	5.7			2.9	2.05	1.4	1.4	1.5
	2.8			6.55	5.55			3.0	2.1	1.5	1.5	1.6
	2.7			6.4				2.9	2.0	1.4	1.4	1.5
	2.8			6.55				2.9	2.1	1.5	1.5	1.6
	2.7			6.5				2.8	2.0	1.4	1.5	1.5
	2.8			6.55			2.7	2.85	2.05	1.5	1.6	1.6
	2.7			6.25			2.6	2.7	1.9	1.4	1.5	1.5
	2.8			6.3			2.7	2.7	2.0	1.5	1.6	1.6
	2.6			6.1			2.6	2.6	1.85	1.4	1.5	1.55
				6.25			2.7	2.6	1.9	1.5	1.65	1.7
				6.15			2.6	2.6	1.8	1.4	1.6	1.6
				6.25			2.6	2.6	1.9	1.5	1.7	1.7
				6.1			2.5	2.5	1.8	1.4	1.6	1.6
				6.2			2.6	2.55	1.9	1.5	1.7	1.55
				6.15			2.5	2.4	1.7	1.4	1.6	1.3
				6.2			2.7	2.5	1.8	1.5	1.7	.....
				5.85			2.6	2.4	1.7	1.4	1.7	.....
				5.85			2.7	2.55	1.8	1.5	1.8	.....
				5.7			2.6	2.65	1.65	1.4	1.7	.....
			5.7	5.7			2.7	2.85	1.7	1.5	1.8	.....
			5.65	5.45			2.55	2.75	1.6	1.4	1.6	.....
			6.1	5.5			2.65	2.75	1.7	1.5	1.7	.....
			6.4	5.4			2.6	2.6	1.6	1.4	1.6	.....
			6.9	5.6			2.65	2.6	1.6	1.5	1.7	.....
			7.15	5.4			2.5	2.4	1.5	1.5	1.6	.....
			7.45	5.5			2.55	2.45	1.6	1.6	1.6	.....
			7.4	5.45			2.4	2.25	1.5	1.5	1.5	.....
			7.4	5.5			2.5	2.3	1.6	1.55	1.6	.....
			7.15	5.5			2.45	2.1	1.45	1.4	1.5	.....
			7.15	.....			2.7	2.2	.....	1.5	.....	.....
a												
				.....	6.45	4.55	3.9	2.4	2.2	4.6	3.65	2.6
				.....	6.8	4.5	3.85	2.4	2.25	4.95	3.6	2.5
				.....	7.05	4.45	4.0	2.4	2.3	5.0	3.5	2.4
				.....	7.0	4.15	4.1	2.4	2.45	5.0	3.5	2.4
				.....	7.2	4.15	4.0	2.3	2.75	4.95	3.4	2.4
				.....	7.45	4.45	3.9	2.2	2.95	4.9	3.4	2.4
				.....	7.3	4.6	3.75	2.2	3.0	4.8	3.3	2.4
				.....	7.2	4.85	3.65	2.1	3.0	4.7	3.3	2.3
				.....	7.15	4.95	3.5	2.1	2.95	4.55	3.2	2.25
				1.7	7.25	4.9	3.4	2.05	2.9	4.5	3.1	2.2
				3.05	7.9	4.95	3.35	2.1	2.9	4.4	3.05	.....
				3.35	8.95	5.15	3.25	2.2	2.85	4.3	3.0	.....
				3.6	9.0	4.95	3.3	2.2	2.8	4.3	3.0	.....
				3.75	8.6	4.7	3.25	2.3	2.8	4.25	3.0	.....
				3.9	8.0	4.55	3.2	2.4	2.85	4.15	3.0	.....
				4.0	7.8	4.35	3.1	2.4	3.1	4.05	3.0	.....
				4.05	7.8	4.15	3.05	2.4	3.35	3.95	2.9	.....
				4.1	7.55	4.0	2.9	2.3	3.4	3.9	2.8	.....
				4.1	7.15	4.0	2.8	2.3	3.6	3.8	2.8	.....
				4.1	6.95	.....	2.6	2.35	3.6	3.7	2.8	.....
				4.2	6.75	.....	2.5	2.4	3.65	3.7	2.8	.....
				4.2	6.5	.....	2.4	2.55	3.7	3.8	2.8	.....
				4.2	6.4	4.55	2.3	2.6	3.7	3.9	2.8	.....
				4.4	6.2	4.55	2.3	2.6	3.7	4.0	2.7	.....
				4.65	5.9	4.6	2.3	2.6	3.85	3.9	2.7	.....
				4.95	5.55	4.5	2.3	2.6	3.95	3.9	2.7	.....
				5.2	5.35	4.45	2.35	2.5	4.1	3.9	2.7	.....
				5.45	5.2	4.45	2.4	2.4	4.2	3.8	2.7	.....
				5.75	4.95	4.5	2.4	2.4	4.2	3.8	2.6	.....
				6.1	4.95	4.1	2.4	2.35	4.4	3.7	2.6	.....
				.....	4.85	.....	2.4	2.3	.....	3.7	.....	.....

d 1904 gage heights corrected in the above table on account of an error in gage datum found 05. Hence the above gage heights do not agree with those previously published.
frozen January 11 to March 20 and December 17-31, 1903.

Daily gage height, in feet, of Moose River near Rockwood Contin

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct
1905.[a]										
1.					5.05	4.6	4.05	2.55	2.0	1.8
2.					5.05	4.4	4.05	2.5	2.0	1.8
3.				4.2	6.05	4.55	4.1	2.4	2.0	1.8
4.				4.45	6.2	4.55	4.1	2.4	2.0	1.8
5.				4.7	6.3	4.75	4.1	2.3	2.05	1.8
6.				4.95	6.45	4.6	4.0	2.3	2.1	1.8
7.				5.0	6.6	4.5	.....	2.3	2.1	1.7
8.				5.15	6.7	4.05	3.85	2.2	2.1	1.7
9.				5.25	6.85	4.9	3.7	2.2	2.05	.....
10.				.....	6.85	5.15	3.6	2.2	2.0	...
11.				5.3	6.9	5.0	3.5	2.2	2.0	1.7
12.				5.4	6.85	5.2	3.4	2.2	2.0	1.6
13.				5.5	6.7	5.1	3.35	2.15	2.0	1.7
14.				5.65	6.6	5.1	3.25	2.1	1.9	1.7
15.				5.8	6.35	.....	3.2	2.1	1.9	1.7
16.				5.85	6.1	4.7	3.1	2.1	1.8	1.7
17.				5.8	5.8	4.65	3.05	2.1	1.8	1.6
18.				5.45	5.7	4.7	3.0	2.05	1.85	1.6
19.				5.2	6.0	4.6	3.0	2.0	1.9	1.6
20.				5.15	6.5	4.6	2.95	2.0	1.9	1.6
21.				5.15	6.5	4.6	2.85	2.0	1.9	1.7
22.				5.25	6.35	4.6	2.8	2.0	1.9	1.7
23.				5.3	6.15	4.55	2.8	2.0	1.9	1.65
24.				5.35	5.9	4.45	2.7	2.0	1.9	1.6
25.				5.35	5.75	4.4	2.7	2.0	1.9	1.6
26.				5.35	5.45	4.3	2.6	2.0	1.9	1.6
27.				5.45	5.55	4.3	2.6	2.1	1.9	1.6
28.				5.6	5.45	4.3	2.6	2.1	1.8	1.6
29.				5.8	5.3	4.25	2.6	2.0	1.8	1.6
30.				5.9	5.4	4.2	2.6	2.0	1.8	1.5
31.				.....	5.05	.....	2.6	2.0	.....	1.5
1906.[b]										
1.	1.8	2.3	2.1	1.5	6.7	5.85	3.75	2.6	1.9	2.1
2.	1.8	2.4	2.0	1.5	6.65	5.5	3.6	2.6	1.8	2.1
3.	1.7	2.4	1.9	1.5	6.85	5.2	3.5	2.5	1.85	2.1
4.	1.9	2.5	1.9	1.5	7.2	5.25	3.5	2.5	1.95	2.1
5.	1.9	2.5	1.9	1.5	7.35	5.35	3.4	2.4	2.0	2.1
6.	1.9	2.6	1.9	1.5	7.85	5.5	3.3	.....	1.9	2.1
7.	1.9	2.6	1.8	1.5	8.0	5.4	3.25	.....	1.95	2.1
8.	1.9	2.6	1.8	1.5	8.0	5.3	3.2	2.3	2.0	2.1
9.	1.9	2.6	1.8	1.5	8.0	5.35	3.1	2.2	2.05	2.1
10.	1.8	2.6	1.9	1.5	8.2	5.5	3.1	2.2	2.1	2.1
11.	1.7	2.6	1.9	1.6	8.55	5.65	3.2	2.15	2.1	2.45
12.	1.7	.....	1.8	1.6	8.6	5.6	3.35	2.1	2.1	2.6
13.	1.7	.....	1.8	1.7	8.5	5.55	3.45	2.0	2.1	2.6
14.	1.7	.....	1.8	1.7	8.4	5.35	3.5	2.0	2.1	2.9
15.	1.7	.....	1.7	1.8	8.3	5.2	3.4	1.95	2.1	3.0
16.	1.7	2.4	1.7	2.0	8.2	5.35	3.4	1.9	2.1	3.0
17.	1.7	2.4	1.6	2.25	8.2	5.25	3.3	1.9	2.1	3.0
18.	1.7	2.3	1.6	2.45	8.3	5.05	3.3	1.85	2.1	3.0
19.	1.7	2.3	1.6	2.65	8.2	4.75	3.25	1.8	2.1	3.0
20.	1.7	2.3	1.6	3.05	8.2	4.5	3.2	1.8	2.1	3.0
21.	1.7	2.3	1.6	3.9	8.2	4.4	3.2	1.8	2.1	3.0
22.	1.7	2.2	1.6	4.8	8.1	4.45	3.1	1.8	2.1	3.0
23.		2.2	1.6	5.3	7.6	4.5	3.1	1.9	2.1	3.0
24.		2.1	1.5	5.5	7.15	4.5	3.05	1.9	2.1	3.1
25.		2.1	1.5	5.75	6.85	4.45	3.0	1.9	2.1	3.2
26.	1.9	2.1	1.4	5.85	6.6	4.25	2.95	1.8	2.1	3.45
27.	2.0	2.1	1.4	6.0	6.5	4.2	2.9	1.9	2.1	3.65
28.	2.0	2.1	1.4	6.35	6.4	4.05	2.85	1.9	2.1	3.8
29.	2.1	...	1.4	6.55	6.45	3.9	2.75	1.9	2.1	4.0
30.	2.2	.....	1.4	6.6	6.25	3.8	2.7	1.9	2.1	4.0
31.	2.2	.....	1.4	.....	6.05	.....	2.7	1.9	.....	4.0

[a] River frozen January 1 to April 2, 1905.

[b] November 14–16, 1905, gage heights omitted, owing to backwater, due to ice.

[c] Gage reader reported no ice near the gage during the winter season 1905–6, with the exce
along the banks of the river, 5 or 6 feet from the gage. Discharge affected by anchor i
1906. River frozen over at the gage December 7; ice 0.4 foot thick December 9, 1906.

ng table for Moose River near Rockwood from September 4, 1902, to December 31, 1906.[a]

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	70	2.60	454	3.90	1,166	5.40	2,432
1.40	88	2.70	496	4.00	1,236	5.60	2,629
1.50	108	2.80	539	4.10	,308	5.80	2,830
1.60	130	2.90	584	4.20	,382	6.00	3,035
1.70	154	3.00	631	4.30	,459	6.20	3,245
1.80	180	3.10	681	4.40	,538	6.40	3,455
1.90	208	3.20	733	4.50	,620	6.60	3,670
2.00	238	3.30	788	4.60	703	6.80	3,890
2.10	270	3.40	846	4.70	788	7.00	4,110
2.20	303	3.56	906	4.80	1,875	7.50	4,685
2.30	338	3.60	968	4.90	1,964	8.00	5,275
2.40	375	3.70	1,032	5.00	2,055	8.50	5,875
2.50	414	3.80	1,098	5.20	2,240	9.00	6,500

his table is applicable only for open-channel conditions. It is based on 11 discharge measurements during 1902-1906. It is well defined between gage heights 1.5 feet and 6.5 feet.

Monthly discharge of Moose River near Rockwood.

[Drainage area, 680 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1902.					
mber 4-30	1,098	375	682	1.00	1.00
ber	1,703	733	919	1.35	1.56
mber	1,703	968	1,237	1.82	2.03
mber	906	539	652	.959	1.11
1903.[a]					
ary 1-10	539	454	513	.754	.28
h 21-31	4,628	2,679	3,874	5.70	2.33
	4,055	2,432	3,061	4.50	5.02
7-31	496	375	454	.668	.62
ist	631	270	462	.679	.78
mber	303	98	184	.271	.30
ber	130	88	101	.149	.17
mber	180	88	131	.193	.22
mber 1-16	154	88	124	.182	.11
1904.[b]					
10-30	3,140	154	1,492	2.19	1.71
	6,500	1,920	4,026	5.92	6.82
(27 days)	2,194	1,236	1,646	2.42	2.43
	1,308	338	704	1.04	1.20
ist	454	254	358	.526	.61
mber	1,538	303	801	1.18	1.32
ber	2,055	1,032	1,420	2.09	2.41
mber	1,000	454	649	.954	1.06
mber 1-10	454	303	370	.544	.20
1905.[c]					
3-30	2,932	1,382	2,353	3.46	3.60
	4,000	2,102	3,189	4.69	5.41
	2,240	1,382	1,742	2.56	2.86
	1,308	454	795	1.17	1.35
ist	434	238	287	.422	.49
mber	270	180	220	.324	.36
ber	180	108	147	.216	.25
mber 1-13, 17-30	180	108	158	.232	.23
mber	238	180	214	.315	.36

iver frozen January 11 to March 20 and December 17-31, 1903.
iver frozen January 1 to April 9 and December 11-31, 1904.
iver frozen January 1 to April 2, 1905. Discharge interpolated on days when gage heights were ead, except November 14-16.

Monthly discharge of Moose River near Rockwood—Continued.

Month	Discharge in second-feet. Maximum.	Minimum.	Mean.	Run-off. Sec.-ft. per sq. mile.	Depth in inches.
[illegible]	303	154	191	0.281	[illegible]
[illegible]	454	270	370	.544	[illegible]
[illegible]	279	88	155	.228	[illegible]
[illegible]	3,670	108	1,040	1.53	[illegible]
[illegible]	7,000	3,088	4,786	7.04	[illegible]
[illegible]	2,861	1,098	2,052	3.02	[illegible]
[illegible]	1,085	496	744	1.09	[illegible]
[illegible]	454	190	264	.388	[illegible]
[illegible]	270	190	255	.375	[illegible]
[illegible]	1,296	270	592	.871	[illegible]
[illegible]	1,166	303	826	1.21	[illegible]
[illegible]	851	454	548	.806	[illegible]
[illegible]	7,000	88	985	1.45	[illegible]

[illegible] Discharge values for December, 1905, slightly [illegible]

MISCELLANEOUS DISCHARGE MEASUREMENTS IN MOOSE RIVER BASIN.

The following miscellaneous discharge measurements were made in Moose River basin in 1905:

Miscellaneous discharge measurements in Moose River drainage basin in 1905.

Date	Hydrographer	Stream	Locality.	Width.	Area of section.	Mean velocity.	Gage height.	Discharge.
				Ft.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
[illegible]	H. K. Barrows.	Moose Stream.	2 miles above Brassua Lake.	15	4.64	0.92	a 2.12	4.3
[illegible]	[illegible]	Brassua Stream.	2½ miles above Brassua Lake.	6	4.06	1.23	a 2.12	5.0
[illegible]	[illegible]	Moose River.	East above Little Brassua Lake and about 4 miles above Brassua Lake.	90	126	1.91	a 2.12	24
Oct.	[illegible]	[illegible]	At outlet of Wood Pond.	82	57	1.12	b 1,157.24	64
Oct.	[illegible]	Outlet Wood Pond.	Near entrance to Wood Pond.	2	.26	.35	b 1,157.24	.9
Oct.	[illegible]	Little Wood Pond Stream.	do	11	3.1	1.23	b 1,157.24	3.8
Nov.	[illegible]	Moose River.	East above Attean Pond.	55	49	1.51	b 1,157.28	74

a Datum is gage height at Rockwood gage.
b Above sea level.
c Measurement made by wading; bed very rough, and measurement considered not good; 0.42 inch rain fell at Jackman during night of October 31.

ROACH RIVER AT ROACH RIVER.

Roach River, which has a total drainage area of 120 square miles, enters Moosehead Lake from the east. Its basin is completely forested. Dams at the outlets of several ponds control the flow of the river. The gage is located about 100 feet downstream from the [illegible] of these dams, at which point the river is so completely under

control that the stage does not vary perceptibly for weeks at a time. Impounded water is used for log driving.

This station was established November 10, 1901, by N. C. Grover. It is located near the village of Roach River, and is reached from Greenville Junction by stage or steamer, or from Kineo by steamer.

The channel is straight and about 60 feet wide. Both banks are high and rocky. The bed of the stream is rocky and permanent. The current is moderate.

Discharge measurements are made by wading or from a canoe at a section 140 feet downstream from the gage.

The gage, which is read twice each day by C. H. Sawyer, is a vertical rod spiked to the timber retaining wall on the right bank of the stream. It is referred to bench marks as follows: (1) A cross cut in the highest timber of the crib to which the gage is spiked; elevation, 8.84 feet. (2) A circular chisel draft marked "B. M." on the highest point of a bowlder near a cottage on the left bank about opposite the dam; elevation, 12.57 feet. Elevations refer to the datum of the gage.

Estimates 1901 to 1903 have been revised, the computations being based on the 1904–5 rating table; 1904 and 1905 estimates remain as previously published.

Values for monthly means as given below are considered to be within 5 per cent of the true flow, except for November, 1905, which may be more than 20 per cent in error. Daily discharges may be in error considerably more than 5 per cent, particularly below gage height 2.5 feet, since the gage heights were read to tenths only and the discharge is very small.

Discharge measurements of Roach River at Roach River.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Sec.-ft.*	1905.	*Feet.*	*Sec.-ft.*
September 2	2.50	112	May 22 [a]	4.07	718
Do	2.70	200	Do	4.45	1,000
Do	2.90	286	May 23 [a]	3.59	524
September 3	2.30	72	November 7 [b]	1.95	5.4
Do	2.11	32	Do	1.90	3.4

[a] From canoe about 100 feet below gage.
[b] By wading about 200 feet below gage.

[illegible] of [illegible] River at [illegible] River.

Day	[illegible]	[illegible]	[illegible]	[illegible]	Nov.	Dec.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.3	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.3	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.3	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.3	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.5	[illegible]	2.5	2.5	2.3	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.5	2.5	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.5	[illegible]	2.5	2.5	2.3	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.5	2.5	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.5	2.4	2.3	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.5	2.4	2.3	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.5	2.4	2.3	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.5	2.8	2.5	2.4	2.3	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0	2.8	2.5	2.4	2.3	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.8	2.5	2.4	2.3	2.5	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.8	2.5	2.4	2.3	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.8	2.5	2.3	2.3	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.8	2.5	2.3	2.3	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.8	2.5	2.3	2.3	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.8	2.5	2.3	2.3	2.5	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.8	2.5	2.3	2.3	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.5	2.3	2.3	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.5	2.3	2.3	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.5	2.3	2.3	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.8	2.5	2.3	2.3	2.5	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.8	2.5	2.3	2.3	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.8	2.8	2.5	2.3	2.3	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	3.5	2.8	2.8	2.5	2.3	2.3	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	[illegible]	3.65	2.8	2.5	2.5	2.3	2.3	2.5	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	2.6	2.8	2.2	2.5	2.3	2.3	2.5	[illegible]
31	[illegible]	[illegible]	[illegible]	[illegible]	2.6	....	2.2	2.5	......	2.3	....	[illegible]

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[illegible]	[illegible]	[illegible]	[illegible]	2.1	2.0	2.2	2.2	2.2	2.1	2.1	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	2.1	2.0	2.2	2.2	2.2	2.1	2.1	[illegible]
3	[illegible]	[illegible]	[illegible]	2.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	[illegible]
4	2.2	2.2	2.2	2.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	[illegible]
5	2.2	2.2	2.2	2.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	[illegible]
6	2.2	2.2	2.2	2.2	2.1	5.0	2.2	2.2	2.2	2.1	2.1	[illegible]
7	2.2	2.2	2.2	2.2	2.1	5.0	2.2	2.2	2.2	2.1	2.1	[illegible]
8	2.2	.....	2.6	3.8	5.4	5.0	2.2	2.2	2.2	2.1	2.1	[illegible]
9	2.2	.	3.0	3.8	5.4	5.0	2.2	2.2	2.2	2.1	2.1	[illegible]
10	2.2	...	3.0	3.8	5.4	5.0	2.2	2.2	2.2	2.1	2.1	[illegible]
11	2.2	.	3.0	3.8	5.4	5.0	2.2	2.2	2.4	2.1	2.1	[illegible]
12	2.2	.	3.0	3.8	2.1	2.0	2.2	2.2	2.4	2.1	2.1	[illegible]
13	2.2	.	3.2	4.0	2.1	2.0	2.2	2.2	2.4	2.1	2.1	[illegible]
14	2.2	.	3.9	5.8	2.1	2.0	2.2	2.2	2.4	2.1	2.1	[illegible]
15	2.2	...	3.9	5.6	2.1	2.0	2.2	2.2	2.4	2.1	2.1	[illegible]

[a] River frozen February 8–27, 1903.

Daily gage height, in feet, of Roach River at Roach River—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
	2.2		3.9	5.4	2.1	2.0	2.2	2.2	2.4	2.1	2.1	2.1
	2.2		3.9	2.2	5.4	2.0	2.2	2.2	2.3	2.1	2.1	2.1
	2.2		3.9	3.8	5.15	2.0	2.2	2.2	2.3	2.1	2.1	2.1
	2.2		3.9	3.8	5.0	2.0	2.2	2.2	2.3	2.1	2.1	2.1
	2.2		3.9	3.8	5.0	2.0	2.2	2.2	2.3	2.1	2.1	2.1
	2.2		3.9	2.2	5.0	2.0	2.2	2.2	2.3	2.1	2.1	2.1
	2.2		3.9	3.8	2.0	2.0	2.2	2.3	2.3	2.1	2.1	2.1
	2.2		2.2	2.15	2.0	2.0	2.2	2.2	2.3	2.1	2.1	2.1
	2.2		2.2	2.1	2.0	2.0	2.2	2.2	2.1	2.1	2.1	2.1
	2.2		2.2	2.1	2.0	5.0	2.2	2.2	2.1	2.1	2.1	2.1
	2.2		4.6	2.1	2.0	5.0	2.2	2.2	2.1	2.1	2.1	2.1
	2.2		4.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	2.1	2.1
	2.2	2.2	4.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	2.1	2.1
	2.2		4.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	2.1	2.1
	2.2		5.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	2.1	2.1
	2.2		5.2	.....	2.0	.....	2.2	2.2	.....	2.1	.....	2.1
1904.[a]												
				2.3	4.8	2.3	2.3	2.2	2.2	2.3	2.3	2.1
				2.3	5.3	5.5	2.3	2.2	2.2	2.3	2.2	2.1
				2.3	5.55	5.5	2.3	2.2	2.2	2.3	2.1	2.1
				2.3	5.4	5.5	2.3	2.2	2.6	2.3	2.1	.....
				2.3	5.4	5.5	2.3	2.2	2.25	2.3	2.1	.....
				2.3	5.4	5.5	2.3	4.0	2.3	2.3	2.1	.....
				2.3	5.4	5.5	2.3	3.8	2.3	2.3	2.1	.....
				2.3	5.4	5.5	2.3	3.0	2.55	2.3	2.1	.....
				2.3	2.3	3.3	2.3	3.0	2.8	2.3	2.1	.....
				2.3	2.3	3.3	2.3	3.0	2.8	2.3	2.1	.....
				2.3	2.3	3.3	2.3	2.6	2.3	2.3	2.1	.....
				2.3	5.4	3.3	2.3	2.6	2.3	2.3	2.1	.....
				2.3	5.4	2.5	2.3	3.4	2.3	2.3	2.1	.....
				2.3	2.3	2.5	2.3	3.4	2.3	2.3	2.1	.....
				2.3	2.3	2.5	2.3	3.4	2.3	2.3	2.1	.....
				2.3	2.3	2.5	2.3	2.85	2.3	2.3	2.1	.....
				2.2	5.5	2.3	2.3	2.3	2.3	2.3	2.1	.....
				2.2	5.5	2.3	2.6	2.3	2.3	2.3	2.1	.....
				2.2	2.3	2.3	2.6	2.3	2.3	2.3	2.1	.....
				2.2	2.3	2.3	2.6	2.3	2.3	2.3	2.1	.....
				2.2	5.5	2.3	2.6	2.3	2.3	2.55	2.1	.....
				2.2	5.5	2.3	3.0	2.3	2.3	2.3	2.1	.....
				2.2	2.3	2.3	2.6	2.7	2.3	2.65	2.1	.....
				2.2	3.9	2.3	2.2	2.7	2.3	3.0	2.1	.....
				2.2	3.9	2.3	2.2	2.2	2.3	3.0	2.1	.....
			2.3	2.2	5.5	2.3	2.2	2.2	2.3	3.0	2.1	.....
			2.3	2.2	2.3	2.3	2.2	2.2	2.3	3.4	2.1	.....
			2.3	2.2	5.5	2.3	2.2	2.6	2.3	3.4	2.1	.....
			2.3	3.3	2.3	2.3	2.2	2.2	2.3	3.4	2.1	.....
			2.3	4.2	5.5	2.3	2.2	2.2	2.3	3.0	2.1	.....
			2.3	.....	5.5	.....	2.2	2.2	.....	3.0	.....	.....
1905.[b]												
				2.2	3.0	2.6	2.4	2.9	2.1	2.2	1.8	.....
				2.2	4.2	2.6	2.4	2.9	2.1	2.2	1.8	.....
				2.2	2.2	2.6	2.4	2.9	2.1	2.2	1.8	.....
				2.2	4.8	2.6	2.4	2.8	2.1	2.2	1.8	.....
				2.2	2.2	3.8	2.4	2.7	2.1	2.2	1.8	.....
				2.2	2.2	3.5	3.5	2.65	2.1	2.2	1.8	.....
				2.2	5.6	2.6	3.5	2.2	2.1	2.2	1.8	.....
				2.2	3.9	2.6	3.5	2.2	2.1	2.2	1.8	.....
				2.2	3.9	2.6	3.5	2.2	2.1	2.2	1.8	.....
				2.2	5.6	2.6	3.5	2.2	2.1	2.2	1.8	.....
				2.2	3.9	2.6	3.5	2.2	2.1	2.2	1.8	.....
				2.2	2.2	2.6	3.5	2.2	2.1	2.2	1.8	.....
				2.2	5.6	2.6	3.5	2.2	2.1	2.2	1.8	.....
				2.2	2.2	3.0	3.4	2.2	2.1	2.2	1.8	.....
				2.2	3.9	3.4	3.4	2.2	2.1	2.0	1.8	.....

[a] River frozen January 1 to March 25 and December 4-31, 1904.
[b] River frozen January 1 to March 20 and November 19 to December 31, 1905.

Daily gage height, in feet, of Roach River at Roach River.

Day	Nov.	Dec.	Day.	Nov.	Dec.
1901.			1901.		
1		2.3	17	2.3	
2		2.3	18	2.3	
3		2.3	19	2.2	
4		2.3	20	2.2	
5		2.3	21	2.2	
6		2.3	22	2.2	
7		2.3	23	2.2	
8		2.3	24	2.2	
9		2.3	25	2.2	
10	2.2	2.3	26	2.2	
11	2.2	2.3	27	2.2	
12	2.2	2.3	28	2.2	
13	2.2	2.3	29	2.2	
14	2.35	2.3	30	2.3	
15	2.3	2.65	31		
16	2.3	3.1			

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.8	2.9	2.6	2.3	5.6	2.5	2.8	2.25	2.5	2.3	2.3	
2	2.8	2.8	2.6	2.3	3.8	2.5	2.8	2.5	2.5	2.3	2.4	
3	2.8	2.8	2.85	2.3	5.4	2.5	2.8	2.5	2.5	2.3	2.5	
4	2.6	2.8	3.0	2.3	3.8	2.5	2.8	2.5	2.5	2.3	2.5	
5	2.6	2.8	3.15	3.75	5.4	2.5	2.8	2.5	2.5	2.3	2.5	
6	2.6	2.8	3.2	5.15	3.8	2.5	2.8	2.5	2.5	2.3	2.5	
7	2.9	2.8	3.2	5.1	3.8	2.5	2.8	2.5	2.5	2.3	2.5	
8	2.9	2.8	3.15	2.3	2.2	2.5	2.8	2.5	2.5	2.3	2.5	
9	2.9	2.8	3.0	5.1	5.5	3.0	2.8	2.5	2.5	2.3	2.5	
10	2.9	2.8	3.0	3.75	3.85	3.0	2.8	2.5	2.4	2.3	2.5	
11	2.9	2.8	3.0	5.2	2.2	3.0	2.8	2.5	2.4	2.3	2.5	
12	2.9	2.8	3.0	3.75	5.5	3.0	2.8	2.5	2.4	2.3	2.5	
13	2.9	2.8	3.0	3.75	3.85	3.0	2.8	2.5	2.4	2.3	2.5	
14	2.9	2.8	3.0	5.2	3.85	3.0	2.8	2.5	2.4	2.3	2.5	
15	2.9	2.6	3.0	3.75	2.2	2.6	2.8	2.5	2.4	2.3	2.5	
16	2.9	2.6	3.0	3.75	5.5	2.6	2.8	2.5	2.4	2.3	2.5	
17	2.9	2.6	3.1	5.2	3.85	2.6	2.8	2.5	2.3	2.3	2.5	
18	2.9	2.6	3.4	5.2	2.2	2.6	2.8	2.5	2.3	2.3	2.5	
19	2.9	2.6	3.5	2.3	2.2	2.6	2.8	2.5	2.3	2.3	2.5	
20	2.9	2.6	4.5	3.75	2.2	2.6	2.8	2.5	2.3	2.3	2.5	
21	2.9	2.6	5.35	3.75	3.85	2.6	2.8	2.5	2.3	2.3	2.5	
22	2.9	2.6	4.0	4.9	3.85	2.8	2.8	2.5	2.3	2.3	2.5	
23	3.1	2.6	4.9	4.9	2.2	2.8	2.8	2.5	2.3	2.3	2.5	
24	3.0	2.6	3.95	5.3	5.5	2.8	2.8	2.5	2.3	2.3	2.5	
25	2.9	2.6	4.2	5.25	5.5	2.8	2.8	2.5	2.3	2.3	2.5	
26	2.9	2.6	3.9	5.1	5.5	2.8	2.8	2.5	2.3	2.3	2.5	
27	2.9	2.6	2.7	2.3	5.5	2.8	2.8	2.5	2.3	2.3	2.5	
28	2.9	2.6	2.2	2.3	3.5	2.8	2.8	2.5	2.3	2.3	2.5	
29	2.9		2.25	4.6	3.05	2.8	2.5	2.5	2.3	2.3	2.5	
30	2.9		2.3	4.9	2.6	2.8	2.2	2.5	2.3	2.3	2.5	
31	2.9		2.3		2.6		2.2	2.5		2.3		
1903.[a]												
1	2.2	2.2	2.2	5.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	
2	2.2	2.2	2.2	5.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	
3	2.2	2.2	2.2	2.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	
4	2.2	2.2	2.2	2.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	
5	2.2	2.2	2.2	2.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	
6	2.2	2.2	2.2	2.2	2.1	5.0	2.2	2.2	2.2	2.1	2.1	
7	2.2	2.2	2.2	2.2	2.1	5.0	2.2	2.2	2.2	2.1	2.1	
8	2.2		2.6	3.8	5.4	5.0	2.2	2.2	2.2	2.1	2.1	
9	2.2		3.0	3.8	5.4	5.0	2.2	2.2	2.2	2.1	2.1	
10	2.2		3.0	3.8	5.4	5.0	2.2	2.2	2.2	2.1	2.1	
11	2.2		3.0	3.8	5.4	5.0	2.2	2.2	2.4	2.1	2.1	
12	2.2		3.0	3.8	2.1	2.0	2.2	2.2	2.4	2.1	2.1	
13	2.2		3.2	4.0	2.1	2.0	2.2	2.2	2.4	2.1	2.1	
14	2.2		3.0	5.8	2.1	2.0	2.2	2.2	2.4	2.1	2.1	
15	2.2		3.9	5.6	2.1	2.0	2.2	2.2	2.4	2.1	2.1	

[a] River frozen February 8–27, 1903.

Daily gage height, in feet, of Roach River at Roach River—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
16	2.2	.....	3.9	5.4	2.1	2.0	2.2	2.2	2.4	2.1	2.1	2.1
17	2.2	.....	3.9	2.2	5.4	2.0	2.2	2.2	2.3	2.1	2.1	2.1
18	2.2	.....	3.9	3.8	5.15	2.0	2.2	2.2	2.3	2.1	2.1	2.1
19	2.2	.....	3.9	3.8	5.0	2.0	2.2	2.2	2.3	2.1	2.1	2.1
20	2.2	.....	3.9	3.8	5.0	2.0	2.2	2.2	2.3	2.1	2.1	2.1
21	2.2	.....	3.9	2.2	5.0	2.0	2.2	2.2	2.3	2.1	2.1	2.1
22	2.2	.....	3.9	3.8	2.0	2.0	2.2	2.3	2.3	2.1	2.1	2.1
23	2.2	.....	2.2	2.15	2.0	2.0	2.2	2.2	2.3	2.1	2.1	2.1
24	2.2	.....	2.2	2.1	2.0	2.0	2.2	2.2	2.1	2.1	2.1	2.1
25	2.2	.....	2.2	2.1	2.0	5.0	2.2	2.2	2.1	2.1	2.1	2.1
26	2.2	.....	4.6	2.1	2.0	5.0	2.2	2.2	2.1	2.1	2.1	2.1
27	2.2	.....	4.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	2.1	2.1
28	2.2	2.2	4.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	2.1	2.1
29	2.2	.....	4.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	2.1	2.1
30	2.2	.....	5.2	2.1	2.0	2.2	2.2	2.2	2.1	2.1	2.1	2.1
31	2.2	.....	5.2	.....	2.0	.....	2.2	2.2	.....	2.1	.....	2.1
1904.[a]												
1	.....	.....	.....	2.3	4.8	2.3	2.3	2.2	2.2	2.3	2.3	2.1
2	.....	.....	.....	2.3	5.3	5.5	2.3	2.2	2.2	2.3	2.2	2.1
3	.....	.....	.....	2.3	5.55	5.5	2.3	2.2	2.2	2.3	2.1	2.1
4	.....	.....	.....	2.3	5.4	5.5	2.3	2.2	2.6	2.3	2.1	.....
5	.....	.....	.....	2.3	5.4	5.5	2.3	2.2	2.25	2.3	2.1	.....
6	.....	.....	.....	2.3	5.4	5.5	2.3	4.0	2.3	2.3	2.1	.....
7	.....	.....	.....	2.3	5.4	5.5	2.3	3.8	2.3	2.3	2.1	.....
8	.....	.....	.....	2.3	5.4	5.5	2.3	3.0	2.35	2.3	2.1	.....
9	.....	.....	.....	2.3	2.3	3.3	2.3	3.0	2.8	2.3	2.1	.....
10	.....	.....	.....	2.3	2.3	3.3	2.3	3.0	2.8	2.3	2.1	.....
11	.....	.....	.....	2.3	2.3	3.3	2.3	2.6	2.3	2.3	2.1	.....
12	.....	.....	.....	2.3	5.4	3.3	2.3	2.6	2.3	2.3	2.1	.....
13	.....	.....	.....	2.3	5.4	2.5	2.3	3.4	2.3	2.3	2.1	.....
14	.....	.....	.....	2.3	2.3	2.5	2.3	3.4	2.3	2.3	2.1	.....
15	.....	.....	.....	2.3	2.3	2.5	2.3	3.4	2.3	2.3	2.1	.....
16	.....	.....	.....	2.3	2.3	2.5	2.3	2.85	2.3	2.3	2.1	.....
17	.....	.....	.....	2.2	5.5	2.3	2.3	2.3	2.3	2.3	2.1	.....
18	.....	.....	.....	2.2	5.5	2.3	2.6	2.3	2.3	2.3	2.1	.....
19	.....	.....	.....	2.2	2.3	2.3	2.6	2.3	2.3	2.3	2.1	.....
20	.....	.....	.....	2.2	2.3	2.3	2.6	2.3	2.3	2.3	2.1	.....
21	.....	.....	.....	2.2	5.5	2.3	2.6	2.3	2.3	2.55	2.1	.....
22	.....	.....	.....	2.2	5.5	2.3	3.0	2.3	2.3	2.3	2.1	.....
23	.....	.....	.....	2.2	2.3	2.3	2.6	2.7	2.3	2.65	2.1	.....
24	.....	.....	.....	2.2	3.9	2.3	2.2	2.7	2.3	3.0	2.1	.....
25	.....	.....	.....	2.2	3.9	2.3	2.2	2.2	2.3	3.0	2.1	.....
26	.....	.....	2.3	2.2	5.5	2.3	2.2	2.2	2.3	3.0	2.1	.....
27	.....	.....	2.3	2.2	2.3	2.3	2.2	2.2	2.3	3.4	2.1	.....
28	.....	.....	2.3	2.2	5.5	2.3	2.2	2.6	2.3	3.4	2.1	.....
29	.....	.....	2.3	3.3	2.3	2.3	2.2	2.2	2.3	3.4	2.1	.....
30	.....	.....	2.3	4.2	5.5	2.3	2.2	2.2	2.3	3.0	2.1	.....
31	.....	.....	2.3	.....	5.5	.....	2.2	2.2	.....	3.0	.....	.....
1905.[b]												
1	.....	.....	.....	2.2	3.0	2.6	2.4	2.9	2.1	2.2	1.8	.....
2	.....	.....	.....	2.2	4.2	2.6	2.4	2.9	2.1	2.2	1.8	.....
3	.....	.....	.....	2.2	2.2	2.6	2.4	2.9	2.1	2.2	1.8	.....
4	.....	.....	.....	2.2	4.8	2.6	2.4	2.8	2.1	2.2	1.8	.....
5	.....	.....	.....	2.2	2.2	3.8	2.4	2.7	2.1	2.2	1.8	.....
6	.....	.....	.....	2.2	2.2	3.5	3.5	2.65	2.1	2.2	1.8	.....
7	.....	.....	.....	2.2	5.6	2.6	3.5	2.2	2.1	2.2	1.8	.....
8	.....	.....	.....	2.2	3.9	2.6	3.5	2.2	2.1	2.2	1.8	.....
9	.....	.....	.....	2.2	3.9	2.6	3.5	2.2	2.1	2.2	1.8	.....
10	.....	.....	.....	2.2	5.6	2.6	3.5	2.2	2.1	2.2	1.8	.....
11	.....	.....	.....	2.2	3.9	2.6	3.5	2.2	2.1	2.2	1.8	.....
12	.....	.....	.....	2.2	2.2	2.6	3.5	2.2	2.1	2.2	1.8	.....
13	.....	.....	.....	2.2	5.6	2.6	3.5	2.2	2.1	2.2	1.8	.....
14	.....	.....	.....	2.2	2.2	3.0	3.4	2.2	2.1	2.2	1.8	.....
15	.....	.....	.....	2.2	3.9	3.4	3.4	2.2	2.1	2.0	1.8	.....

[a] River frozen January 1 to March 25 and December 4-31, 1904.
[b] River frozen January 1 to March 20 and November 19 to December 31, 1905.

[illegible] Daily gage height of Lower Lake at Lower Dam, in feet—Continued.

Day	[illegible]	[illegible]	[illegible]	May	June	July	August	September	October	November	December
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											
31											

[illegible] November 21, 1905, gage height to top of ice, 1.8 feet; thickness of ice, 0.1 foot.

[illegible] River frozen January 1 to April 15, 1906, except a small portion of the channel which was open opposite the gage for the greater part of the winter season. The thickness of the ice varied from 0.2 to 0.[illegible] foot. Flow probably somewhat affected by ice conditions December, 1906.

Rating table for Roach River at Roach River, from November 10, 1901, to December 31, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	0.8	2.70	186	3.80	640	4.90	1,110
1.85	1.5	2.80	221	3.90	685	5.00	1,225
1.90	3.4	2.90	258	4.00	730	5.20	1,335
1.95	6.5	3.00	298	4.10	775	5.40	1,445
2.00	12	3.10	338	4.20	820	5.60	1,555
2.10	27	3.20	379	4.30	865	5.80	1,670
2.20	46	3.30	421	4.40	915	6.00	1,790
2.30	68	3.40	463	4.50	965	6.20	1,910
2.40	94	3.50	506	4.60	1,015		
2.50	122	3.60	550	4.70	1,065		
2.60	153	3.70	595	4.80	1,115		

[a] This table is applicable only for open-channel conditions. It is based on 10 discharge measurements made during 1902–1905. It is fairly well defined.

Monthly discharge of Roach River at Roach River.

[Drainage area, 85 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1901.					
November 10–30	81	46	54.0	0.635	0.50
December	572	68	246	2.89	3.33
1902.					
January	338	153	248	2.92	3.37
February	258	153	188	2.21	2.30
March	1,418	46	417	4.91	5.66
April	1,390	68	775	9.12	10.18
May	1,555	46	740	8.71	10.04
June	298	122	194	2.28	2.54
July	221	46	207	2.44	2.81
August	122	57	120	1.41	1.63
September	122	68	90.3	1.06	1.18
October	68	68	68.0	.80	.92
November	122	68	119	1.40	1.56
December	122	46	105	1.24	1.43
The year	1,555	46	273	3.21	43.62
1903.[a]					
January	46	46	46.0	.541	.62
February (8 days)	46	46	46.0	.541	.16
March	1,335	46	468	5.51	6.35
April	1,670	27	479	5.64	6.29
May	1,445	12	408	4.80	5.53
June	1,225	12	340	4.00	4.46
July	46	46	46.0	.541	.62
August	46	46	46.0	.541	.62
September	94	27	56.3	.662	.74
October	27	27	27.0	.318	.37
November	27	27	27.0	.318	.35
December	27	27	27.0	.318	.37
1904.[b]					
March 26–31	68	68	68.0	.800	.18
April	820	46	96.0	1.13	1.26
May	1,528	68	912	10.73	12.37
June	1,500	68	456	5.36	5.98
July	298	46	83.4	.981	1.13
August	730	46	182	2.14	2.47
September	221	46	80.8	.952	1.06
October	463	68	149	1.75	2.02
November	68	27	29.0	.341	.38

[a] River frozen February 8–27, 1903.
[b] River frozen January 1 to March 25 and December 4–31, 1904.

[illegible]

[illegible]

MOOSEHEAD LAKE.

[illegible] Moosehead Lake level at Moosehead [illegible] of Moosehead Lake, p. 132) has been [illegible] by the Hollingsworth & Whitney Company. [illegible] by gage readings at Greenville for a por- [illegible] furnished for publication by the company. [illegible] staff gages set to the same datum, and that [illegible] East Outlet is referred to the following bench [illegible] a large rock near the left end of the dam: [illegible] above gage datum, zero of which is approxi- [illegible] the gate sills and 1,011.30 feet above mean sea [illegible]. The gage readings in the following table are referred to a datum 10 feet higher—that is, with zero at the sill of the gates.

[illegible] of Moosehead Lake.

[illegible]	[illegible]	Date.	Gage height.	Date.	Gage height.
[illegible]	*Feet.*	1895.	*Feet.*	1895.	*Feet.*
April 3	[illegible]	June 27	4.2	September 21	1.2
April 6	1.62	June 28	3.55	September 28	.1
April 17	1.8	July 5	3.55	October 11	.9
April 19	2.75	July 9	3.45	October 15	.8
April 22	4.35	July 13	3.3	October 22	.7
April 26	4.15	July 19	3.08	October 24	.7
May 3	5.15	July 26	2.75	November 1	.6
May 6	5.55	August 3	2.65	November 8	.6
May 10	5.9	August 9	2.45	November 15	.6
May 13	6.12	August 17	2.25	November 22	1.7
May 17	6.7	August 20	1.9	November 29	2.4
May 22	6.92	August 23	1.8	December 6	3.05
May 24	6.5	August 27	1.85	December 13	3.5
May 31	6.0	August 30	1.8	December 20	3.85
June 7	5.5	September 6	1.55	December 27	4.04
June 14	5.05	September 13	1.3		

Gage heights, in feet, of Moosehead Lake— Continued.

Date.	Gage height.	Date.	Gage height.	Date.	Gage height.
1896.	*Feet.*	1897.	*Feet.*	1898.	*Feet.*
.....	4.7	April 16	4.0	September 2	1.85
0.....	5.5	April 23	4.7	September 9	1.95
7.....	5.2	April 30	6.8	September 16	1.75
4.....	5.3	May 7	7.55	September 23	1.6
1.....	5.2	May 14	7.6	September 30	1.7
7.....	5.2	May 21	7.55	October 6	1.75
14.....	5.1	May 28	7.6	October 7	1.75
21.....	4.9	June 4	7.6	October 10	1.65
28.....	4.75	June 11	7.45	October 14	1.35
.....	5.0	June 18	7.15	October 17	1.7
.....	5.05	June 25	6.6	October 21	1.85
.....	5.3	July 2	6.15	October 24	1.95
.....	5.25	July 9	5.75	October 28	2.15
.....	5.45	July 16	6.02	November 4	2.5
.....	5.4	July 23	5.95	November 11	2.6
.....	5.6	July 30	5.8	November 18	2.9
.....	6.75	August 6	5.7	November 25	3.2
.....	6.8	August 13	5.35	December 2	3.55
.....	6.9	August 20	5.15	December 9	3.8
.....	7.35	August 27	4.75	December 16	3.85
.....	7.3	September 3	4.35	December 23	3.9
.....	7.35	September 10	3.8	December 30	3.95
.....	7.4	September 17	3.25	December 31	3.95
.....	7.45	September 24	3.2		
.....	7.4	October 1	3.05	1899.	
.....	6.85	October 8	2.95	January 6	3.85
.....	6.25	October 15	2.97	January 13	3.8
.....	6.02	October 22	2.95	January 20	3.8
.....	5.8	October 29	2.85	January 27	3.75
.....	5.45	November 5	2.95	January 28	3.75
.....	5.15	November 12	3.2	February 3	3.7
.....	4.64	November 20	3.25	February 5	3.6
.....	4.5	November 26	3.25	February 10	3.5
.....	4.2	December 3	3.55	February 12	3.45
.....	3.9	December 10	3.85	February 19	3.4
.....	3.5	December 17	4.25	February 24	3.2
.....	3.15	December 24	4.6	February 25	3.2
.....	2.8	December 31	4.75	March 3	3.0
.....	2.5			March 10	2.85
.....	2.1	1898.		March 15	2.75
r 4.....	1.8	January 2	4.7	March 17	2.7
r 11.....	2.0	January 7	4.75	March 24	2.9
r 18.....	1.8	January 14	4.65	March 31	2.95
r 25.....	1.7	January 21	4.65	April 4	2.8
.....	1.75	January 28	4.7	April 7	2.9
.....	1.75	February 4	4.65	April 9	2.9
6.....	1.8	February 11	4.45	April 14	2.95
3.....	1.95	February 18	4.35	April 21	3.5
0.....	2.25	February 25	4.5	April 27	5.0
r 6.....	2.7	February 28	4.35	April 28	5.05
r 13.....	3.3	March 2	4.35	May 5	7.4
r 20.....	3.7	March 4	4.3	May 12	7.45
r 27.....	4.8	March 8	4.0	May 19	7.15
5.....	4.45	March 10	3.85	May 26	6.65
11.....	4.5	March 11	3.75	June 2	6.5
18.....	4.65	March 18	3.45	June 9	6.25
25.....	4.65	March 20	3.35	June 16	5.8
30.....	4.6	March 25	3.2	June 23	5.35
		April 1	3.3	June 30	4.75
1897.		April 4	3.4	July 7	4.45
.....	4.55	April 6	3.1	July 14	4.4
.....	4.65	April 8	3.75	July 21	4.5
.....	4.65	April 15	4.4	July 28	4.45
1.....	4.65	April 22	5.7	August 4	4.2
5.....	4.65	April 29	6.9	August 11	3.9
3.....	4.65	May 6	7.2	August 18	3.75
7.....	4.6	May 13	7.6	August 25	3.5
9.....	4.6	May 20	7.55	September 1	3.2
5.....	4.45	May 27	7.2	September 8	2.8
12.....	4.3	June 10	6.6	September 15	2.5
19.....	4.1	June 17	6.3	September 22	2.25
23.....	4.1	June 24	5.75	September 29	1.95
26.....	4.1	July 1	5.25	October 6	1.9
.....	3.9	July 8	4.75	October 13	1.75
.....	3.75	July 16	4.05	October 20	1.65
.....	3.8	July 22	3.75	October 27	1.4
.....	3.8	July 29	3.35	November 3	1.4
.....	3.75	August 5	3.2	November 10	1.5
.....	3.8	August 12	2.9	November 17	1.2
.....	3.85	August 19	2.5	November 24	1.5
.....	3.9	August 26	2.2	December 1	1.4

Gage heights, in feet, of Moorehead Lake—Continued.

Date.	Gage height.	Date.	Gage height.	Date.	Gage height.
1899.	*Feet.*	1900.	*Feet.*	1901.	
December 4	1.5	December 14	3.9	December 27	
December 8	1.6	December 21	3.85	December 30	
December 12	1.35	December 28	3.8		
December 15	1.55			1902.	
December 22	1.7	1901.		January 3	
December 29	1.8	January 4	3.6	January 10	
		January 11	3.5	January 17	
1900.		January 18	3.4	January 24	
January 2	1.8	January 25	3.25	January 31	
January 5	.75	February 1	3.25	February 3	
January 12	.8	February 8	3.2	February 7	
January 19	.7	February 15	3.0	February 14	
January 26	.95	February 22	2.8	February 21	
February 2	2.2	March 1	2.6	February 28	
February 9	2.45	March 8	2.0	March 7	
February 16	2.5	March 15	1.4	May 4	
February 23	2.7	March 22	1.5	May 9	
March 2	3.25	March 29	1.75	May 16	
March 9	3.6	April 5	2.5	May 23	
March 16	3.7	April 12	3.5	May 27	
March 23	3.8	April 19	6.1	May 29	
March 30	3.6	April 26	7.8	May 30	
April 6	3.4	May 3	7.5	June 6	
April 13	3.3	May 10	7.5	June 13	
April 20	3.9	May 17	7.5	June 15	
April 27	6.15	May 24	7.45	June 20	
May 4	7.0	May 31	7.1	June 27	
May 11	7.45	June 7	6.6	July 4	
May 20	7.8	June 14	6.4	July 11	
June 1	7.6	June 21	6.05	July 19	
June 22	6.7	June 30	5.7	July 25	
June 29	6.3	July 14	5.25	August 1	
July 6	5.95	July 19	4.85	August 8	
July 13	5.65	July 26	4.4	August 15	
July 20	5.8	August 2	4.0	August 22	
July 27	5.8	August 9	4.0	August 29	
August 3	5.6	August 16	4.4	September 6	
August 10	5.25	August 23	4.4	September 12	
August 17	4.85	August 30	4.25	September 19	
August 24	4.45	September 6	4.1	September 26	
August 31	4.1	September 13	3.75	October 4	
September 7	3.7	September 20	3.4	October 10	
September 14	3.15	September 27	3.2	October 17	
September 21	2.9	October 4	3.0	October 24	
September 28	2.9	October 11	2.5	October 30	
October 5	2.25	October 18	2.3	November 14	
October 12	2.5	October 25	2.4	November 17	
October 19	2.5	November 1	2.1	November 21	
October 26	2.5	November 8	1.85	November 28	
November 2	2.4	November 15	1.85	December 5	
November 9	2.2	November 22	1.7	December 12	
November 16	2.8	November 29	1.55	December 19	
November 23	3.3	December 6	1.45	December 26	
November 30	3.8	December 13	1.25		
December 7	3.85	December 20	2.6		

Date.	Gage height.		Date.	Gage height.		Date.
	Outlet.	Greenville.		Outlet.	Greenville.	
1903.	*Feet.*	*Feet.*	1903.	*Feet.*	*Feet.*	1903.
January 2	4.05		April 1	6.36		May 9
January 8	5.05		April 8	6.5		May 11
January 9	4.8		April 10	6.2		May 12
January 14	5.05		April 12	6.5		May 13
January 16	4.6		April 14	6.65		May 15
January 23	4.55		April 17	6.6		May 16
January 30	4.45		April 21	6.2		May 19
February 6	4.25		April 24	6.0		May 22
February 13	4.5		April 27	6.3		May 27
February 22	3.8		April 28	6.75		May 29
March 1	3.45		April 30	6.4		June 2
March 6	3.0		May 2		6.5	June 4
March 13	3.1		May 3	6.75		June 6
March 20	3.9		May 5		6.8	June 10
March 23	4.5		May 6	6.95		June 12
March 27	5.4		May 8		6.9	June 17

Gage heights, in feet, of Moosehead Lake—Continued.

	Gage height.		Date.	Gage height.		Date.	Gage height.	
	Outlet.	Greenville.		Outlet.	Greenville.		Outlet.	Greenville.
	Feet.	*Feet.*	1903.	*Feet.*	*Feet.*	1904.	*Feet.*	*Feet.*
....	5.75	5.8	September 13..	2.5	.....	May 30.....	7.1	7.0
....	.....	5.75	September 14..	.....	2.5	May 31.....	.....	7.1
....	5.7	.....	September 15..	2.4	2.4	June 1.....	.....	7.0
....	.....	5.7	September 16..	.....	2.4	June 2.....	.....	6.95
....	5.55	5.65	September 17..	.....	2.35	June 3.....	7.0	6.95
....	.....	5.6	September 18..	2.2	2.35	June 4.....	.....	7.0
....	5.6	5.55	September 19..	.....	2.3	June 6.....	6.95	7.0
....	.....	5.55	September 21..	.....	2.15	June 8.....	7.5	.....
....	.....	5.55	September 22..	.....	2.15	June 9.....	.....	7.05
....	5.4	.....	September 23..	1.9	2.0	June 10.....	7.2	.....
....	.....	5.45	September 24..	.....	1.95	June 13.....	6.9	6.95
....	5.05	5.3	September 25..	1.6	1.95	June 14.....	.....	6.85
....	.....	5.25	September 26..	.....	1.85	June 15.....	6.75	6.7
....	5.2	5.15	September 28..	1.6	1.7	June 16.....	.....	6.75
....	5.4	5.2	September 29..	.....	1.75	June 17.....	6.5	6.7
....	4.9	.....	September 30..	.....	1.7	June 18.....	.....	6.65
....	4.8	4.8	October 1.....	.....	1.6	June 20.....	6.45	6.6
....	.....	4.75	October 2.....	1.5	.....	June 21.....	.....	6.4
....	.....	4.75	October 3.....	.....	1.55	June 22.....	.....	6.35
....	4.7	.....	October 5.....	.....	1.45	June 23.....	.....	6.4
....	.....	4.7	October 6.....	.....	1.45	June 24.....	6.3	.....
....	.....	4.65	October 9.....	1.2	.....	June 25.....	.....	6.3
....	4.35	4.6	October 11.....	1.2	.....	June 27.....	5.95	6.25
....	.....	4.55	October 12.....	.....	1.25	June 28.....	.....	6.15
....	4.45	4.55	October 13.....	.....	1.25	June 29.....	6.1	.....
....	.....	4.5	October 14.....	.....	1.2	June 30.....	.....	6.0
....	4.35	.....	October 15.....	.....	1.15	July 1.....	6.05	6.0
....	.....	4.4	October 16.....	1.05	1.05	July 2.....	.....	6.0
....	4.2	4.3	October 17.....	.....	1.0	July 4.....	6.1	.....
....	.....	4.25	October 19.....	.....	1.0	July 6.....	6.0	.....
....	.....	4.2	October 20.....	.9	.9	July 7.....	.....	6.0
....	4.15	4.25	October 21.....	.....	.95	July 8.....	5.9	6.05
....	.....	4.15	October 23.....	.75	.85	July 9.....	.....	6.0
....	4.05	.....	October 26.....	.7	.....	July 11.....	5.9	5.9
....	.....	4.3	October 29.....	.....	.75	July 12.....	5.9	5.9
....	.....	4.0	October 30.....	.6	.....	July 13.....	.....	5.9
....	3.9	3.9	October 31.....	.....	.7	July 14.....	.....	6.0
....	.....	3.9	November 2.....	.....	.7	July 15.....	5.9	5.95
....	3.87	3.95	November 3.....	.....	.65	July 16.....	.....	5.9
....	.....	3.9	November 4.....	.....	.7	July 18.....	5.8	5.85
....	.....	3.85	November 6.....	.6	.7	July 19.....	.....	5.8
....	3.7	3.8	November 7.....	.....	.8	July 20.....	5.7	5.75
....	.....	3.7	November 9.....	.....	.6	July 21.....	.....	5.7
....	.....	3.65	November 10.....	.....	.6	July 22.....	5.55	5.65
....	3.6	.....	November 11.....	.....	.6	July 23.....	.....	5.6
....	.....	3.6	November 13.....	.5	.....	July 25.....	5.3	5.5
....	3.5	.....	November 20.....	.45	.....	July 26.....	.....	5.45
....	.....	3.45	November 27.....	.2	.....	July 27.....	5.2	5.4
....	.....	3.45	December 4.....	.15	(a)	July 28.....	.....	5.25
....	.....	3.4				July 29.....	5.15	5.2
....	.....	3.45	1904.			July 30.....	.....	5.2
....	3.25	3.35	April 29.....	1.35	1.85	August 1.....	5.0	.....
....	.....	3.35	April 30.....	.....	1.95	August 2.....	.....	4.95
....	3.4	3.25	May 2.....	.....	2.25	August 3.....	4.75	4.9
....	.....	3.25	May 3.....	2.2	2.45	August 4.....	.....	4.85
....	.....	3.15	May 4.....	.....	2.6	August 5.....	4.7	4.75
....	.....	3.2	May 5.....	.....	2.95	August 8.....	.....	4.5
....	3.15	.....	May 6.....	3.0	3.15	August 10.....	.....	4.45
....	.....	3.3	May 7.....	.....	3.5	August 11.....	.....	4.35
....	3.3	3.3	May 9.....	.....	3.9	August 12.....	4.3	4.4
....	.....	3.3	May 11.....	.....	4.45	August 13.....	.....	4.3
....	3.25	3.3	May 12.....	.....	4.9	August 15.....	4.2	4.25
....	.....	3.25	May 13.....	5.0	5.2	August 16.....	.....	4.25
....	3.2	3.25	May 14.....	.....	5.45	August 17.....	4.1	4.15
....	.....	3.2	May 16.....	.....	5.9	August 18.....	.....	4.15
....	3.1	.....	May 17.....	.....	6.1	August 19.....	4.05	.....
1....	.....	3.1	May 18.....	5.9	6.25	August 20.....	.....	4.1
3....	.....	3.0	May 19.....	.....	6.45	August 22.....	4.05	4.0
4....	2.9	.....	May 20.....	.....	6.6	August 24.....	4.5	4.05
5....	.....	3.0	May 21.....	.....	6.65	August 25.....	.....	4.05
7....	2.75	2.9	May 22.....	6.5	.....	August 26.....	3.95	4.0
8....	.....	2.8	May 23.....	6.6	6.8	August 27.....	.....	4.0
9....	.....	2.7	May 24.....	.....	6.9	August 29.....	3.85	.....
10..	2.6	2.6	May 25.....	6.8	7.0	August 30.....	.....	3.8
11..	.....	2.6	May 26.....	.....	7.0	August 31.....	3.7	.....
12..	.....	2.55	May 27.....	6.9	7.0	September 1...	.....	3.65
			May 28.....	.....	7.1	September 2...	3.55	3.55

bout December 4, 1903, to April 29, 1904, no gage readings were obtained, as water was
ottom of the gage.

Gage heights, in feet, of Moosehead Lake—Continued.

Date	Gage height		Date.	Gage height.		Date.	Gage
	Outlet.	Greenville.		Outlet.	Greenville.		Outlet
1904.	*Feet.*	*Feet.*	1905.	*Feet.*	*Feet.*	1905.	*Feet*
September 3		3.55	February 17	1.5	.....	June 27	
September 5	3.6	.....	February 20	1.35	.....	June 28	5.5
September 6		3.7	February 23	1.2	.....	June 29	
September 7	3.55	3.55	February 24	1.2	.....	June 30	5.9
September 8		3.5	February 28	1.1	.....	July 1	
September 9	3.5	3.5	March 10	.6	.....	July 3	5.9
September 11		3.45	March 13	.6	.....	July 4	
September 12	3.4	3.35	March 15	.45	.....	July 5	5.7
September 13		3.4	March 17	.4	.....	July 6	
September 14	3.35	3.3	March 20	.4	.....	July 7	5.6
September 15		3.35	March 22	.4	.....	July 8	
September 16	3.5	3.35	March 24	.3	.....	July 10	5.6
September 17		3.45	March 31	.....	1.6	July 11	
September 19	3.65	.....	April 1	.....	1.65	July 12	5.5
September 26	3.8	.....	April 3	.....	1.8	July 13	
September 28	3.85	.....	April 4	.....	1.8	July 14	5.5
September 30		3.9	April 5	1.0	1.9	July 15	
October 1		4.1	April 6	.....	2.0	July 17	5.5
October 3	4.35	4.25	April 7	2.05	2.15	July 18	
October 4		4.25	April 8	.....	2.25	July 19	5.2
October 5	4.45	4.35	April 10	2.35	2.4	July 20	
October 6		4.45	April 11	.....	2.5	July 21	5.0
October 7		4.55	April 12	2.7	2.6	July 22	
October 8	4.55		April 13	.....	2.75	July 24	4.8
October 9		5.1	April 14	2.9	2.9	July 25	
October 10	4.8	4.5	April 15	.....	3.0	July 26	4.7
October 12	4.8	4.65	April 17	.....	3.25	July 27	
October 14		4.7	April 18	3.35	3.35	July 28	4.6
October 17	4.6	4.65	April 19	.....	3.35	July 31	4.6
October 19	4.6		April 20	.....	3.5	August 1	
October 21	4.7	4.6	April 21	3.55	3.6	August 2	4.5
October 24	4.85		April 22	.....	3.8	August 3	
October 25		4.8	April 24	3.85	3.95	August 4	4.3
October 26	4.9		April 25	.....	4.0	August 5	
October 27		4.95	April 26	4.05	4.1	August 7	4.2
October 28	4.95		April 27	.....	4.25	August 8	
October 31	5.05	5.05	April 28	4.3	.....	August 9	4.1
November 2	5.5	5.05	April 29	.....	4.45	August 10	
November 4		5.15	May 1	4.6	4.7	August 11	4.1
November 7	4.9	5.15	May 2	.....	4.75	August 12	
November 9	4.85		May 3	4.95	4.8	August 14	3.8
November 11	5.0		May 4	.....	5.05	August 15	
November 14	5.5	5.1	May 5	5.25	5.1	August 16	3.8
November 18	5.1		May 6	.....	5.25	August 18	3.5
November 25	5.0		May 8	5.6	5.6	August 19	
November 25	5.0		May 9	.....	5.6	August 21	3.4
November 28	4.95		May 10	5.85	5.9	August 22	
November 30	4.9		May 11	.....	5.9	August 23	3.3
December 2	4.85		May 12	6.0	5.95	August 25	3.2
December 5	4.8		May 13	.....	5.9	August 26	
December 7	4.75		May 15	6.1	6.1	August 28	3.1
December 9	4.8		May 16	.....	6.1	August 30	
December 12	4.75		May 17	6.2	6.15	August 31	3.0
December 14	4.75		May 18	.....	6.2	September 1	2.9
December 16	4.7		May 19	6.45	6.3	September 2	
December 19	4.6		May 20	.....	6.5	September 4	2.9
December 21	4.55		May 22	6.7	6.75	September 5	
December 23	4.4		May 23	.....	6.8	September 6	2.8
December 25	4.2		May 24	6.7	6.75	September 7	
December 28	4.15		May 25	.....	6.7	September 8	2.8
			May 26	6.6	6.7	September 9	
1905.			May 27	.....	6.8	September 11	2.7
January 1	4.0		May 29	6.7	6.75	September 12	
January 4	3.9		May 30	.....	6.8	September 13	
January 6	3.85		May 31	6.7	6.75	September 14	
January 10	3.7		June 1	.....	6.75	September 15	2.65
January 11	3.55		June 2	.....	6.6	September 18	2.5
January 13	3.5		June 3	.....	6.8	September 19	
January 16	3.4		June 5	.....	6.6	September 20	2.45
January 18	3.0		June 6	.....	6.65	September 21	
January 21	2.9		June 7	.....	6.5	September 22	2.47
January 28	2.2		June 8	.....	6.45	September 23	
January 30	2.0		June 9	.....	6.4	September 25	
February 2	1.9		June 13	.....	6.35	September 26	
February 3	1.85		June 19	6.3	.....	September 27	2.35
February 6	1.75		June 21	6.3	.....	September 28	
February 8	1.85		June 23	6.2	.....	September 29	2.25
February 10	1.8		June 24	.....	6.25	September 30	
February 15	1.7	.....	June 26	6.1	6.1	October 2	2.2

Gage heights, in feet, of Moosehead Lake —Continued.

Date.	Gage height.		Date.	Gage height.		Date.	Gage height.	
	Outlet.	Greenville.		Outlet.	Greenville.		Outlet.	Greenville.
1905.	*Feet.*	*Feet.*	1906.	*Feet.*	*Feet.*	1906.	*Feet.*	*Feet.*
er 4	.....	2.15	February 7	0.4	.....	June 25	7.1	7.0
er 5	.....	2.25	February 9	.35	.....	June 26	.....	7.15
er 6	2.15	2.15	February 12	.3	.....	June 27	7.05	7.15
er 7	.....	2.1	February 14	.5	.....	June 28	.....	7.1
er 9	2.05	2.1	February 16	.6	.....	June 29	6.95	7.0
er 10	.....	2.0	February 19	.7	.....	June 30	.....	7.0
er 11	.....	1.9	February 21	.7	.....	July 1	6.85	.....
er 12	1.8	1.85	February 27	.8	.....	July 2	6.7	.....
er 13	.....	1.9	February 28	.8	.....	July 3	.....	6.7
er 16	1.8	1.8	March 3	.8	.....	July 4	6.55	6.55
er 18	.....	1.75	March 5	.7	.....	July 5	.....	6.6
er 19	1.7	1.75	March 7	.7	.....	July 6	6.35	6.5
er 20	.....	1.7	March 9	.7	.....	July 7	.....	6.35
er 21	1.7	1.75	March 12	.7	.....	July 9	6.15	.....
er 23	1.7	1.7	March 13	.75	.....	July 10	.....	6.1
er 24	.....	1.65	March 16	.8	.....	July 11	6.0	6.1
er 25	1.7	1.7	March 20	.86	.....	July 12	.....	6.0
er 26	.....	1.6	March 21	.9	.....	July 13	5.9	5.95
er 27	1.5	1.55	March 24	.9	.....	July 14	.....	5.9
er 28	.....	1.5	March 26	.9	.....	July 16	5.7	5.75
er 30	1.55	.....	March 28	.8	.....	July 17	.....	5.6
er 31	.....	1.4	March 30	.8	.....	July 18	5.6	5.7
nber 1	1.5	1.3	April 2	.9	.....	July 19	.....	5.6
nber 2	.....	1.4	April 4	.95	.....	July 20	5.5	5.55
nber 3	1.35	1.3	April 6	.95	.....	July 21	.....	5.5
nber 4	.....	1.3	April 9	1.0	.....	July 23	5.4	5.4
nber 6	1.3	1.3	April 11	1.0	.....	July 24	.....	5.4
nber 7	.....	1.35	April 17	1.1	.....	July 25	5.33	5.4
nber 8	1.25	1.3	April 18	1.2	.....	July 26	.....	5.35
nber 9	.....	1.3	April 23	1.8	.....	July 27	5.2	.....
nber 10	1.3	.....	April 25	2.05	.....	July 28	.....	5.2
nber 13	1.3	1.35	April 27	2.4	.....	July 30	5.0	4.45
nber 15	1.27	1.35	April 30	2.88	.....	July 31	.....	5.05
nber 17	1.25	1.15	May 1	.....	3.0	August 1	4.9	4.95
nber 18	.....	1.25	May 2	3.3	3.15	August 2	.....	4.95
nber 20	1.18	1.15	May 4	3.75	4.4	August 3	4.8	4.9
nber 21	.....	1.15	May 5	.....	3.85	August 4	.....	4.8
nber 24	1.0	1.0	May 7	4.58	.....	August 6	4.65	4.65
nber 25	.....	1.0	May 8	.....	4.6	August 7	.....	4.65
nber 27	.95	.....	May 9	5.05	4.9	August 8	4.5	4.65
nber 28	.....	1.0	May 10	.....	5.35	August 9	.....	4.5
nber 29	1.05	.....	May 11	5.9	5.75	August 10	4.35	.....
nber 30	.....	1.0	May 12	.....	6.0	August 11	.....	4.25
ıber 1	.9	.....	May 14	5.95	6.55	August 13	4.1	4.25
ıber 4	.8	.....	May 15	.....	6.85	August 14	.....	4.2
ıber 5	.....	.9	May 16	7.15	7.1	August 15	3.95	4.15
ıber 6	.78	.....	May 17	.....	7.2	August 16	.....	4.0
ıber 7	.....	.9	May 18	7.32	7.35	August 17	3.85	3.9
ıber 8	.78	.....	May 19	.....	7.4	August 18	.....	3.85
ıber 9	.....	.9	May 21	.....	7.5	August 20	3.75	3.75
ıber 11	.95	.....	May 23	7.5	7.5	August 21	.....	3.7
ıber 12	.....	.9	May 24	.....	7.5	August 22	.....	3.65
ıber 14	.9	.....	May 25	.....	7.55	August 23	.....	3.65
ıber 15	.8	.....	May 28	7.5	.....	August 24	3.6	3.7
ıber 18	.7	.....	May 29	.....	7.55	August 25	.....	3.6
ıber 20	.75	.....	May 30	7.45	7.6	August 27	3.4	3.45
ıber 24	.7	.....	May 31	.....	7.5	August 29	3.3	.....
ıber 25	.6	.....	June 1	7.46	7.45	August 30	.....	3.2
ıber 27	.6	.....	June 2	.....	7.45	August 31	3.15	3.2
ıber 29	.5	.....	June 4	7.45	7.4	September 1	.....	3.2
			June 5	.....	7.45	September 3	3.1	3.1
906.[a]			June 6	7.42	7.5	September 4	.....	3.1
ry 2	.5	.....	June 7	.....	7.5	September 5	2.95	3.1
ry 4	.5	.....	June 8	7.4	7.4	September 6	.....	3.0
ry 5	.45	.....	June 9	.....	7.4	September 7	2.85	3.0
ry 10	.4	.....	June 11	7.4	7.5	September 8	.....	3.0
ry 13	.35	.....	June 12	.....	7.5	September 10	2.75	2.9
ry 15	.4	.....	June 13	7.4	7.5	September 11	.....	2.8
ry 17	.3	.....	June 14	.....	7.4	September 12	2.75	2.8
ry 19	.3	.....	June 15	7.35	7.4	September 13	.....	2.8
ry 22	.25	.....	June 16	.....	7.35	September 14	2.5	2.8
ry 24	.25	.....	June 18	7.25	7.3	September 15	.....	2.8
ry 26	.5	.....	June 19	.....	7.25	September 17	2.45	2.5
ry 29	.45	.....	June 20	7.1	7.2	September 18	.....	2.5
ry 31	.5	.....	June 21	.....	7.1	September 19	2.4	2.5
ary 2	.5	.....	June 22	7.0	7.1	September 20	.....	2.5
ary 5	.45	.....	June 23	.....	7.0	September 21	2.4	2.4

[a] Lake frozen over January 1 to May 13 and December 2-31, 1906.

Gage heights, in feet, of Moosehead Lake—Continued.

Date.	Gage height.		Date.	Gage height.		Date.	Gage height.	
	Outlet.	Greenville.		Outlet.	Greenville.		Outlet.	Greenville.
1906.	Feet.	Feet.	1906.	Feet.	Feet.	1906.	Feet.	Feet.
[illegible]		2.2	October 30		2.2	November 17		
[illegible]			October 22	2.1	2.2	November 19	3.0	
[illegible]	2.1	2.1	October 23		2.2	November 20		
[illegible]		2.1	October 24	2.2		November 21	3.0	
[illegible]	2.0	2.1	October 25		2.2	November 22		
[illegible]		2.0	October 26	2.5		November 23	3.2	
[illegible]	2.1		October 27		2.3	November 24		
[illegible]		2.0	October 28	2.6	2.5	November 26	3.3	
[illegible]		2.0	October 30		2.4	November 27		
[illegible]	2.0	2.0	October 31	2.8	2.4	November 28	3.3	
[illegible]		2.1	November 1		2.4	November 29		
[illegible]	2.1	2.2	November 2	2.8	2.5	November 30	3.3	
[illegible]		2.2	November 3		2.5	December 3	3.25	
[illegible]	2.1	2.2	November 5	2.85	2.8	December 6	3.3	
[illegible]		2.2	November 6		2.8	December 7	3.4	
[illegible]	2.1	2.2	November 7	2.9	2.9	December 12	3.25	
[illegible]		2.2	November 8		2.9	December 14	3.2	
[illegible]	2.2	2.2	November 9	3.0	2.9	December 17	3.2	
[illegible]		2.2	November 10		2.9	December 19	3.2	
[illegible]	2.2		November 12	3.0	2.9	December 21	3.2	
[illegible]		2.2	November 13		2.9	December 24	3.1	
[illegible]	2.2	2.2	November 14	2.9	2.9	December 26	3.1	
[illegible]		2.2	November 15		2.9	December 28	3.05	
[illegible]	2.2	2.2	November 16	3.0	2.9			

DEAD RIVER NEAR THE FORKS.

Dead River has its headwaters in the mountains between Maine and Canada and flows in a general easterly direction, entering the Kennebec at The Forks. Its basin is 40 miles in extreme length by 30 miles in width and is almost entirely covered with forests. For a large portion of its length the river flows through swamps; in its lower course it has considerable fall. The only dams on the stream are owned by the log-driving companies, and the gates are kept open after the drives are out of the river.

This gaging station was established September 29, 1901, by N. C. Grover. It is located 1½ miles west of The Forks.

The channel is straight for 500 feet above and below the station and is about 225 feet wide at ordinary stages. The banks are rocky and are subject to overflow in extreme freshets. The bed is rocky and permanent. The current is rapid.

The gage, which is read twice each day by Jeremiah Durgin, jr., is a vertical rod attached to a large bowlder on the left bank about 70 feet below the cable. It is referred to a bench mark, a copper bolt set in a bowlder 0.5 foot from the gage; elevation, 7.97 feet above the zero of the gage.

No revision has been made in estimates previously published for this station.

Values for monthly means as given below are considered to be within 5 per cent of the true flow for discharge greater than 500 second-feet. Below this point the probable error increases gradually.

ing about 10 to 15 per cent for a discharge of 170 second-feet. The ily discharges are subject to much larger errors.

Discharge measurements of Dead River near The Forks.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1901.	*Feet.*	*Sec.-ft.*	1904.	*Feet.*	*Sec.-ft.*
tember 29[a]	0.40	255	June 21	1.05	676
			July 27	.72	279
1903.			August 29	.78	370
ne 5	.90	399			
ne 6	.90	401	1905.		
y 15	1.10	737	April 21	1.82	1,810
gust 18	.89	452	June 1	1.75	1,520
vember 4	.69	211	Do	1.75	1,510
Do	.69	214	July 18	1.09	690
1904.			1906.		
ne 8	3.00	3,470	May 8	4.35	7,700
ne 9	6.35	15,300	Do	4.28	7,490
ne 21	1.05	655	September 5	.85	385

[a] By wading.

Daily gage height, in feet, of Dead River near The Forks.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1901.[a]					1901.				
		0.35	0.5	0.8	17		1.6	0.5	
		.4	.4	.8	18		1.3	.4	
		.4	.5	.7	19		.95	.4	
		.4	.5	.7	20		.85	.5	
		.4	.5	.7	21		.8	.5	
		.35	.45	.8	22		.65	.5	
		.3	.4	.8	23		.7	.6	
		.3	.4	.7	24		.8	.6	
		.3	.4		25		.8	.6	
		.3	.4		26		.8	.6	
		.3	.4		27		.7	.7	
		.3	.4		28		.7	.7	
		.4	.45		29	0.4	.6	.7	
		.5	.5		30	.4	.55	.8	
		.8	.5		31		.5		
		1.5	.5						

[a] Ice conditions November 20 to December 31, 1901.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.[a]										
					2.57	2.1	0.8	1.05	2.8	1.0
					2.1	2.4	.9	1.1	2.65	1.0
					1.85	2.2	1.0	1.0	2.0	1.0
					1.55	2.0	1.0	1.0	1.75	1.2
					1.7	1.9	1.1	1.0	1.6	1.2
					1.5	1.75	1.0	.9	1.55	1.1
					1.4	1.55	1.1	1.3	1.45	1.1
					1.4	1.35	1.0	1.55	1.35	1.0
					1.3	1.3	.9	1.45	1.25	1.0
					1.1	1.4	1.0	1.3	1.1	1.0
					1.0	1.3	1.1	1.2	1.1	1.1
					.8	1.2	1.45	1.25	1.0	1.2
					1.2	1.1	1.75	1.45	.9	1.1
					1.15	1.0	1.8	1.6	.75	1.1
					1.1	1.0	1.7	1.6	1.1	1.1
					1.1	1.1	1.6	1.6	1.7	1.1
					1.1	1.0	1.5	2.0	1.9	1.1
					1.0	1.1	1.5	1.75	1.8	1.15
					1.0	1.0	1.6	1.0	1.8	1.2
					1.0	.9	1.75	1.0	1.65	1.3

[a] 1902 gage heights have been revised to agree with observer's original record. Ice conditions probably existed during December, 1902.

Daily gage height, in feet, of Dead River near The Forks—Continu

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	
1902.									
21					0.75	0.8	1.9	0.95	
22					.6	.8	1.8	.9	
23					.8	.7	1.7	.8	
24					.7	.7	1.6	.8	
25				1.6	1.0	1.8	1.6	1.1	
26				4.55	1.25	1.45	1.45	1.2	
27				3.05	1.05	1.3	1.25	1.1	
28				3.3	1.2	1.2	1.1	1.2	
29				4.15	1.45	1.1	1.1	1.0	
30				3.2	1.65	1.0	1.1	1.35	
31					2.0	.7	.....	2.8	
1903.[a]									
1					1.0	1.35	.9	.6	
2					1.0	1.4	.8	.6	
3					1.0	1.4	.8	.6	
4				1.0	1.0	1.3	.7	.6	
5				1.0	.9	1.15	.7	.6	
6				1.0	.9	1.05	.8	.5	
7				.9	.9	1.0	.7	.5	
8				.9	1.0	1.0	.7	.5	
9				.9	.95	.9	.7	.5	
10				.9	.9	.9	.7	.5	
11				1.85	1.0	.9	.7	.5	
12				2.8	1.0	.9	.6	.5	
13				4.8	1.0	.9	.6	.5	
14				3.8	1.0	.9	.6	.5	
15				2.9	1.1	.9	.6	.5	
16				2.2	1.1	1.0	.6	.6	
17				1.95	1.1	1.0	.6	.6	
18				1.8	1.1	.9	.6	.6	
19				2.0	1.1	.9	.6	.6	
20				2.15	1.0	.9	.6	.6	
21				2.05	1.0	1.0	.6	.6	
22				1.7	1.0	1.1	.6	.6	
23				1.5	1.0	1.3	.6	.6	
24				1.4	.9	1.35	.6	.6	
25				1.3	1.1	1.2	.6	.6	
26				1.1	1.35	1.1	.5	.6	
27				1.0	1.5	1.05	.5	.6	
28				1.0	1.25	1.0	.5	.7	
29				1.1	1.15	1.0	.5	.7	
30				1.1	1.1	.9	.6	.7	1
31					1.2	.9	.....	.7	
1904.[b]									
1			4.15	2.25	1.05	.95	.75	2.15	1
2			4.9	2.45	1.2	.95	.75	3.05	1
3			5.35	4.15	1.45	.85	.75	3.0	1
4			5.9	3.45	1.7	.85	.85	2.7	1
5		4.95	6.85	2.45	1.55	.8	1.25	2.6	1
6			5.25	4.65	1.4	.75	1.45	2.55	1
7			4.55	3.45	1.25	.75	1.3	2.25	1
8			4.45	4.65	1.2	.65	1.2	1.7	1
9			4.15	4.75	1.0	.65	1.05	1.4	1
10		2.85	4.75	4.5	1.0	.65	1.05	1.35	1
11		2.05	5.15	3.75	1.1	.75	.95	1.25	1
12		3.25	4.55	3.45	1.4	.75	.95	1.25	1
13		3.35	4.25	2.6	1.5	.85	1.05	1.15	1
14		3.35	4.05	2.1	1.5	.95	1.25	1.25	1
15		2.35	5.6	1.8	1.3	.95	1.6	1.15	1
16		2.2	4.3	1.5	1.15	.85	1.8	1.15	1
17		1.95	4.6	1.4	1.0	.85	1.7	1.25	1
18		1.8	4.15	1.2	1.05	.85	1.5	1.15	1
19		1.85	6.15	1.05	.95	.85	1.35	1.15	1
20		1.85	5.55	1.05	.95	.75	1.45	1.15	1

[a] Gage carried away during the winter by ice; replaced June 4, 1903. Ice conditions during 1903.

[b] River frozen over January 1 to April 5 and December 11-31, 1904; clear of ice April 9. during frozen period.

[c] Anchor ice affects gage readings.

Daily gage height, in feet, of Dead River near The Forks—Continued.

ay.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
04.										
		1.85	5.65	1.05	0.95	1.15	1.35	1.7	1.05	.....
		1.95	5.45	1.1	.95	1.65	1.35	2.15	1.05	.....
		2.05	4.8	1.15	.85	1.7	1.35	2.55	1.05	.....
		2.35	4.65	1.2	.85	1.5	1.25	2.75	1.05	.....
		2.5	2.85	1.35	.75	1.05	1.25	2.6	1.05	.....
		3.3	3.05	1.45	.75	.9	1.4	2.4	1.05	.....
		3.0	5.4	1.45	.65	.8	1.6	1.85	.95	.....
		3.85	2.9	1.35	.65	.75	1.65	1.65	1.0	.....
		6.05	4.85	1.2	.75	.75	1.75	1.5	1.0	.....
		4.45	2.75	1.1	.85	.75	1.85	1.4	.95	.....
		.....	1.95	.....	.95	.75	.....	1.35	.....	.....
05.a										
		3.6	3.9	2.6	1.75	1.85	.75	.75	.75	1.15
		3.35	4.15	2.55	2.2	1.85	.75	.75	.85	1.1
		3.4	3.55	1.9	2.3	1.55	.75	.75	.85	1.05
		2.9	5.85	1.7	2.4	1.4	.85	.75	.85	1.05
		2.6	4.25	1.65	2.2	1.2	.95	.75	.85	1.15
		2.45	4.05	1.65	2.0	1.0	1.05	.75	.85	1.15
		2.35	4.2	1.75	1.8	1.0	1.2	.75	.85	1.15
		2.35	4.25	1.65	1.6	1.05	1.25	.65	.95	1.15
		2.35	4.15	1.6	1.5	1.05	1.1	.65	.95	1.15
		2.45	4.3	1.55	1.45	1.05	.95	.65	.95	1.15
		2.45	4.55	1.55	1.35	1.05	.95	.65	.85	1.15
		2.65	4.15	1.8	1.45	.95	.85	.65	.75	1.05
		2.5	4.1	2.3	1.3	.95	.75	.65	.75	1.05
		2.3	3.8	2.2	1.2	1.05	.75	.65	.85	1.05
		2.35	3.5	1.95	1.1	1.05	.75	.75	.85	1.05
		2.35	5.7	1.85	1.05	1.15	.75	.75	.85	1.05
		2.95	5.05	1.85	1.0	1.3	.75	.75	.85	.....
		2.85	4.05	1.75	1.05	1.45	.9	.75	.95	.....
		2.2	3.8	2.0	1.25	1.3	1.1	.75	.95	.....
		1.9	5.2	2.3	1.65	1.15	1.15	.75	.95	.....
		2.4	5.1	2.65	1.95	1.15	1.05	.75	.95	.....
		3.25	4.85	2.65	1.35	1.05	.95	.75	.85	.....
		4.95	4.65	2.4	1.1	1.05	.95	.75	.85	.....
		2.35	4.75	2.2	1.1	1.05	.95	.75	.85	.....
		2.3	4.6	2.05	1.15	.95	.9	.75	.85	.....
		2.15	5.15	2.05	1.15	.95	.8	.75	.95	.....
		2.3	4.35	1.95	1.05	.85	.75	.75	.95	.....
	4.85	3.2	4.45	1.95	.95	.85	.75	.75	1.05	.....
	3.85	3.4	4.55	1.85	.95	.85	.75	.65	1.15	.....
	2.8	3.15	4.15	1.75	.95	.75	.75	.65	1.15	.....
	3.5	.....	2.85	.....	1.5	.75	.....	.65	.....	.....
06.b										
		.....	3.85	3.55	1.25	.85	.75	.75	1.4	.95
		.....	4.4	2.35	1.15	.85	.85	.75	1.3	.95
		.....	4.1	2.15	1.15	.75	.85	.75	1.25	1.05
		.....	4.2	1.95	1.15	.75	.8	.75	1.15	1.05
		.....	3.7	2.95	1.15	.75	.75	.75	1.05	1.05
		.....	4.35	3.05	1.15	.75	.75	.65	1.05	1.15
		.....	4.35	3.7	1.05	.75	.75	.65	.95	1.25
		.....	3.65	3.95	1.05	.65	.75	.65	.95	1.25
		.....	3.85	3.7	1.05	.65	.75	1.15	.95	1.25
		2.65	3.9	2.7	1.2	.65	.75	1.4	.95	1.15
		2.65	4.25	3.6	1.3	.65	.85	1.65	1.05	1.25
		2.55	4.75	3.95	1.65	.65	.85	1.55	1.05	1.25
		2.45	3.95	2.5	1.8	.65	.8	1.65	.95	1.25
		2.45	4.05	2.0	1.65	.65	.75	1.3	.95	.....
		2.35	3.8	1.95	1.6	.65	.75	1.25	1.05	.....
		2.6	3.85	1.6	1.35	.65	.75	1.15	1.05	.....
		3.0	3.85	1.7	1.35	.6	.75	.95	1.05	.....
		3.2	4.35	1.55	1.35	.55	.75	.95	1.05	.....
		3.4	3.9	1.45	1.35	.65	.75	.9	1.05	.....
		3.6	3.65	1.4	1.25	.65	.75	.85	1.05	.....

r frozen January 1 to March 27, 1905; ice went out March 28 and river clear. River frozen
ır 16–31, 1905.
r frozen January 1 to April 10, and December 14–31, 1906.

Daily gage height, in feet, of Dead River near The Forks—Contin

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1906.								
21		3.85	3.85	1.35	1.25	.75	.75	.85
22		4.55	3.4	1.25	1.25	.75	.75	1.25
23		4.65	4.0	1.5	1.25	.75	.75	1.5
24		4.15	3.4	1.65	1.25	.85	.85	1.8
25		3.8	3.55	2.0	1.15	.85	.85	1.85
26		3.4	2.6	1.9	1.15	.85	.75	1.95
27		3.0	3.0	1.8	1.05	.75	.75	2.05
28		3.25	3.05	1.6	.95	.75	.75	1.9
29		3.55	3.95	1.4	.95	.75	.75	1.85
30		3.45	3.25	1.35	.85	.75	.65	1.7
31			3.15		.85	.75		1.55

Rating table for Dead River near The Forks from June 25, 1902, to Decemb

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Di char
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec*
0.40	45	1.50	1,225	2.60	2,970	4.40	7.7
0.50	110	1.60	1,365	2.70	3,160	4.60	8.4
0.60	185	1.70	1,505	2.80	3,360	4.80	9.1
0.70	270	1.80	1,650	2.90	3,570	5.00	9.8
0.80	365	1.90	1,795	3.00	3,790	5.50	11.9
0.90	470	2.00	1,945	3.20	4,240	6.00	14.0
1.00	580	2.10	2,100	3.40	4,730	6.50	16.3
1.10	700	2.20	2,260	3.60	5,260	7.00	18.7
1.20	825	2.30	2,430	3.80	5,830		
1.30	955	2.40	2,600	4.00	6,430		
1.40	1,090	2.50	2,780	4.20	7,060		

[a] This table is applicable only for open-channel conditions. It is based on 19 discharge made during 1903-1906. It is well defined between gage heights 0.7 foot and 2 feet.

Monthly discharge of Dead River near The Forks.

[Drainage area, 870 square miles.]

Month.	Discharge in second-feet.			R
	Maximum.	Minimum.	Mean.	Sec.-ft. sq. mi
1902.[a]				
June 25-30	8,245	1,365	4,855	5.
July	2,913	185	954	1.
August	2,600	270	991	1.
September	1,795	365	1,022	1.
October	3,360	365	942	1.
November	3,360	318	1,226	1.
1903.				
June 1-30	9,140	470	1,748	2.
July	1,225	470	646	.
August	1,090	470	648	.
September	470	110	222	.
October	270	110	172	.
November	580	270	357	.
1904.[b]				
April 10-30	14,300	1,650	3,722	4.
May	18,040	1,870	8,892	10.
June	8,960	640	2,989	3.
July	1,505	228	705	.
August	1,505	228	495	.
September	1,722	318	967	1.
October	3,900	762	1,770	2.
November	1,022	525	741	.
December 1-10	1,090	525	712	.

[a] Estimates for December, 1902, and December, 1903, omitted on account of ice conc
[b] River frozen January 1 to April 9 and December 11-31, 1904.

Monthly discharge of Dead River near The Forks—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.[a]					
April	9,700	1,795	3,352	3.85	4.30
May	13,420	3,465	7,821	8.99	10.36
June	3,065	1,295	1,955	2.25	2.51
July	2,600	525	1,180	1.36	1.57
August	1,722	318	739	.849	.98
September	890	318	475	.546	.61
October	318	228	289	.332	.38
November	762	318	470	.540	.60
December 1-16	762	640	705	.810	.48
1906.[b]					
April 10-30	8,600	2,515	4,586	5.27	4.12
May	8,960	2,970	5,936	6.82	7.86
June	6,280	890	2,593	2.98	3.32
July	1,650	418	867	.997	1.15
August	418	148	292	.336	.39
September	417	227	337	.387	.43
October	2,022	227	934	1.07	1.23
November	1,090	525	701	.806	.90
December 1-13	890	525	756	.869	.42

[a] River frozen January 1 to March 28 and December 16-31, 1905.
[b] Ice conditions January 1 to April 10 and December 14-31, 1906.

CARRABASSETT RIVER AT NORTH ANSON.

Carrabassett River enters the Kennebec from the west at North Anson. Its basin has steep slopes, partly in farm lands, with no large natural reservoirs. Dams have been constructed and power used at New Portland, East New Portland, and North Anson.

The gaging station was established October 19, 1901, by N. C. Grover. It is located above Embden Brook and below Anson Brook, about 4 miles from North Anson.

The channel is straight for 500 feet above and 300 feet below the station and is about 150 feet wide, divided into two parts at low stages of the river by a gravelly bar. The bed is of coarse gravel and is permanent, and the current is moderately rapid.

Discharge measurements are made by wading at low stages and from a boat at high stages.

Gage readings are taken once each day by N. Q. Hilton. There are two gages. One is a vertical rod attached to a tree; the other is a standard chain gage attached to trees on the bank. The length of the chain is 36.73 feet. The datum of the two gages is the same and is referred to a bench mark, a copper bolt set in a large bowlder at the outlet of Anson Brook; elevation, 11.40 feet above the zero of the gage.

Estimates as previously published for 1902 to 1904, inclusive, have been revised and are now based on the 1905 rating curve.

Values for monthly means, as given below, are considered to be within 5 per cent of the true flow for discharges greater than 600

second-feet. Below this point the error may range between 5 and 30 per cent. This is due to changing conditions of flow and the larger errors in general occur only over relatively short periods of time. The probable error of a given low monthly flow can be estimated somewhat closely by comparing the percentage error of the nearest low-water measurement, in point of time, with the rating table for the gage height of the measurement.

Discharge measurements of Carrabassett River at North Anson.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Sec.-ft.*	1903.	*Feet.*	*Sec.-ft.*
June 27	4.30	4,170	August 15	0.71	300
July 30	.60	192	September 23	.15	76
October 30	2.47	1,810	November 6	.30	165
October 30	2.67	2,120			
October 31	1.99	1,370	1904.		
November 1	1.69	1,130	August 30	.40	154
November 1	1.60	1,080			
November 2	1.42	882	1905.		
November 3	1.35	851	July 20 [a]	1.18	436
1903.			October 26 [b]	.40	146
May 26	.45	208	1906.		
July 17	.90	348	September 7	.06	107

[a] Log jam in left channel 500 feet below gage. [b] Measurement made by wading near gage.

Daily gage height, in feet, of Carrabassett River at North Anson.

Day.	Nov.	Dec.	Day.	Nov.	Dec.
1		0.6	16	0.2	
2		.6	17	.2	
3	0.4	.6	18	.2	
4	.4	.5	19	.5	
5	.4	.5	20	.4	
6	.3	.5	21	.3	
7	.3	(a)	22	.2	
8	.3		23	.2	
9	.3		24	.2	
10	.3		25	.2	
11	.3		26	.2	
12	.2		27	.2	
13	.2		28	.2	
14	.2		29	.2	
15	.2		30	.1	

[a] River frozen December 7 to 31, 1901.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902. [a]										
1					1.4	0.4	0.7	0.9	1.7	1.0
2					1.8	.4	.8	1.1	1.5	1.0
3					1.6	1.5	.7	1.0	1.4	.9
4					1.5	1.2	.7	.9	1.3	1.0
5					1.3	1.0	.9	.8	1.2	1.1
6					1.1	.9	.8	1.2	1.1	1.1
7					1.0	.8	.7	1.7	1.1	1.2
8					.9	.8	.9	1.3	1.1	1.2
9					.8	.8	.8	1.1	1.1	1.1
10					.8	.8	2.8	1.1	1.0	1.1
11					.9	.7	1.9	1.0	1.0	1.0
12					.7	.9	1.4	.9	1.0	.9
13					.7	.9	1.2	.9	1.1	
14					.6	.7	2.8	.9	1.1	
15					.6	.6	2.1	1.0	1.4	

[a] River frozen December 13-31, 1902.

Daily gage height, in feet, of Carrabassett River at North Anson—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.										
					0.6	0.5	1.6	0.9	1.5	
					.6	.5	1.3	.8	1.5	
					.6	.5	1.1	.8	1.3	
					.5	.5	1.0	.8	1.2	
					.6	.3	1.4	1.4	1.2	
					.6	.3	1.3	1.6	1.2	
					1.0	.3	1.1	1.3	1.1	
					1.0	6.4	1.0	1.1	1.2	
					.8	3.6	1.1	1.1	1.1	
					.8	2.3	.9	.9	1.1	
				4.8	.7	1.6	.8	1.0	1.0	
				4.9	.6	1.4	.8	.9	1.0	
				3.1	.6	1.1	.8	1.5	1.1	
				2.2	.6	1.0	1.0	4.3	1.0	
				1.7	.5	.8	1.0	2.5	1.0	
					.5	.7		2.0		
1903.[a]										
		2.9	1.9	0.2	.5	1.4	.4	.2	.3	0.4
		2.5	1.9	.1	.6	1.0	.4	.1	.3	.3
		2.2	1.3	.2	.8	.8	.4	.1	.3	.3
		3.7	1.3	.2	.6	.7	.4	.1	.3	.3
		4.0	1.2	.2	.5	.6	.3	.2	.2	.3
		2.7	1.2	.2	.5	.5	.5	.5	.3	.4
		2.3	1.2	.1	.5	.6	.3	.5	.4	.3
		2.2	1.3	.1	.5	.5	.3	.4	.4	.4
		3.5	1.2	.1	.5	.5	.3	.4	.3	.4
		3.6	1.2	.1	.6	.5	.2	.6	.4	.5
		3.3	1.3	.1	.5	.4	.3	.5	.3	.5
		2.6	1.2	.1	.6	1.7	.2	.4	.4	.5
		2.4	1.1	11.1	.6	1.2	.3	.4	.4	.6
		2.2	1.0	8.3	.6	.9	.3	.5	.3	.6
		2.2	1.0	4.1	.4	.7	.3	.4	.2	.6
		2.2	.9	2.8	1.2	.5	.2	.4	.3	.8
		2.1	.7	2.1	.9	.6	.3	.4	.3	.7
		1.9	.7	1.8	.7	.6	.3	.7	.4	.8
		1.7	.7	1.5	.5	.5	.3	1.3	.5	1.0
		1.7	.7	1.8	.7	.6	.2	.8	.4	.9
		1.6	.9	1.6	.7	1.6	.2	.7	.3	2.6
		1.5	.7	1.4	1.4	1.1	.2	.6	.4	2.6
		1.5	.6	1.2	1.2	.9	.2	.5	.4	2.5
		1.5	.5	1.0	2.9	.7	.1	.5	.3	2.4
		1.5	.5	.9	2.0	.6	.1	.5	.8	2.3
		1.5	.5	.9	1.5	.6	.1	.5	1.1	2.3
		1.4	.4	.8	1.1	.6	.1	.5	.5	2.4
		1.5	.4	.7	.9	.6	.2	.4	.4	2.3
		1.7	.4	.6	.8	.5	.3	.5	.3	2.3
	2.1	1.9	.2	.6	1.0	.4	.3	.4	.3	2.0
	2.4		.2		1.7	.4		.3		2.0
1904.										
			7.3	.9	.4	.7	.3	2.1	1.1	.8
			4.9	.9	.8	.7	.3	1.8	1.1	.8
			4.0	.8	1.0	.6	.3	1.4	1.0	1.0
	[b] 1.9		4.2	.8	.9	.5	.5	1.2	1.0	1.1
			4.4	.8	.6	.4	.7	1.0	1.0	.9
			3.7	1.1	.6	.4	.5	.9	.8	.8
			3.8	2.3	.7	.4	.4	.9	.8	1.0
			2.6	1.8	.5	.4	.4	.8	.8	.8
			2.4	1.5	.4	.4	.3	.8	.7	.7
		4.7	9.5	1.3	.3	.4	.3	.8	.8	.7
		5.2	5.8	1.1	.3	.6	.3	.7	.8	.7
		4.1	4.6	.9	2.3	1.3	.3	.7	.8	.7
		3.3	3.5	.8	1.5	1.2	.4	.7	.6	.6
		2.7	2.9	.7	1.9	.9	.3	.8	.7	.7
		2.2	2.4	.6	1.4	.9	.9	.8	.9	.6

er frozen January 1 to March 29 and December 31, 1903.
ge reading to water surface in hole cut in ice at gage; otherwise no readings during frozen season,

Daily gage height, in feet, of Carrabassett River at North Anson—Contir

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	N
1904.									
16		1.9	11.3	0.5	1.1	0.8	1.9	0.8	
17		1.6	6.6	.5	.8	.7	1.3	.7	
18		1.7	4.1	.5	.7	.6	1.0	.7	
19		1.8	3.3	.4	.5	.5	.9	.7	
20		2.8	4.4	.4	.4	.4	.9	.6	
21		2.5	3.1	.3	.4	2.7	.9	.6	
22		2.3	2.5	.3	.3	1.6	.9	.4	
23		2.5	2.2	.5	.3	1.3	.8	2.5	
24		3.2	2.0	.5	.2	1.0	.7	1.9	
25		3.9	1.7	.4	.3	.8	.5	1.6	
26		3.4	1.6	.6	.3	.7	.4	1.4	
27		3.7	1.5	.4	.2	.5	.4	1.9	
28		3.4	1.4	.3	.9	.5	.4	1.6	
29		4.7	1.3	.1	1.8	.5	.7	1.5	
30		7.1	1.2	.2	1.4	.4	2.8	1.3	
31		.....	1.0	.....	.9	.4	.....	1.2	
1905.[a]									
1		3.0	2.3	1.0	.9	2.9	.3		
2		2.8	2.0	.9	.9	1.5	.3		
3		2.3	1.4	.9	2.7	1.2	.3		
4		2.1	3.6	1.0	1.9	.9	2.2		
5		1.9	3.1	.8	1.5	.7	1.4		
6		4.0	2.6	.8	1.2	.7	1.9		
7		3.6	2.6	1.0	1.0	.6	1.4		
8		2.7	2.5	.8	.9	.9	1.2		
9		2.2	2.0	.7	.8	.8	1.0		
10		2.2	2.1	.7	.8	.7	.8		
11		2.9	1.7	.6	.8	.6	.7		
12		2.7	1.5	.7	.7	.5	.6		
13		2.8	1.5	3.8	.6	.5	.7		
14		2.7	1.6	2.4	.5	.7	.8		
15		2.8	1.5	1.8	.5	.5	.7		
16		2.4	1.6	1.5	.5	.6	.6		
17		2.0	2.0	1.3	.5	.9	.6		
18		1.8	2.2	1.1	.6	.7	.8		
19		1.6	3.0	1.4	1.2	.6	1.7		
20		1.4	2.5	1.7	1.2	.5	1.3		
21		1.3	1.9	1.8	.9	.5	1.3		
22		3.4	1.7	1.5	.7	.4	1.1		
23		2.6	1.5	1.4	.6	.4	1.0		
24		2.1	1.3	1.2	.5	.3	1.0		
25		2.0	1.2	1.0	.7	.2	.7		
26		1.9	1.1	.9	.5	.3	.6		
27		2.2	1.3	1.8	.4	.3	.7		
28		1.9	1.5	1.5	.7	.5	.5		
29	4.0	2.1	1.3	1.2	.4	.4	.5		
30		2.0	1.2	1.0	.3	.3	.5		
31		.....	1.1	.....	1.3	.3	.....		
1906.[b]									
1		2.9	3.0	1.5	.5	1.1	.3	.1	
2		2.7	4.0	1.4	.5	1.0	.2	0	
3		2.4	3.5	1.7	.6	.7	.3	0	
4		2.3	3.8	1.7	.6	.5	.6	.2	
5		2.5	3.5	1.4	.7	.4	.5	.2	
6		3.0	3.1	1.3	.7	.4	.3	.3	
7		3.3	3.2	2.0	.9	.3	.1	.4	
8		2.9	2.8	1.9	.7	.2	.1	.2	
9		2.8	2.3	1.8	.6	.1	.1	.5	
10		2.9	4.1	1.8	.9	.2	.2	4.0	
11		2.7	3.6	1.4	.8	.1	.4	3.1	
12		2.5	2.7	1.2	1.6	.1	.2	2.2	
13		2.4	2.3	1.3	1.2	.1	.1	1.5	
14		2.3	2.6	1.1	1.0	0	0	1.1	
15		3.0	1.9	.8	.8	.2	.1	.9	

[a] River frozen January 1 to March 26, 1905; ice broke up March 26 and went out March
[b] River frozen January 1 to April 16, 1906, when the ice broke up; ice went out April 1

Daily gage height, in feet, of Carrabassett River at North Anson—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.										
.....	.....	5.1	1.8	0.7	0.6	0	−0.1	0.8	0.6	0.9
.....	.....	5.5	1.8	.6	.5	0	− .1	.7	.7	.9
.....	.....	5.1	2.2	.6	.5	0	0	.5	.6	.9
.....	.....	4.8	2.2	.7	.7	0	0	.5	.7	1.0
.....	.....	4.8	2.1	.6	.5	0	0	.6	1.4	1.0
.....	.....	4.8	1.5	.6	.4	0	0	.8	1.2	1.1
.....	.....	4.9	1.4	.3	.9	.5	− .1	.7	1.2	1.4
.....	.....	5.1	1.3	.4	.7	.3	0	.8	1.2	1.8
.....	.....	3.4	1.3	2.3	1.3	.3	.1	.7	1.1	2.1
.....	.....	2.8	1.3	1.8	1.0	.3	0	.7	1.1	1.9
.....	.....	2.7	1.8	1.3	.7	.2	− .1	3.5	1.1	1.9
.....	.....	2.6	1.8	1.2	.6	.1	0	2.4	.9	1.8
.....	.....	2.5	3.2	.7	.4	1.7	0	2.2	.8	1.8
.....	.....	2.8	3.0	.6	.4	.9	0	2.1	1.0	1.8
.....	.....	3.3	2.3	.6	.3	.5	0	1.6	.6	1.7
.....	.....	.....	1.8	.....	1.7	.4	.....	1.1	.....	1.5

Rating tables for Carrabassett River at North Anson.

NOVEMBER 3, 1901, TO DECEMBER 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.10	55	1.30	755	2.50	1,900	3.70	3,345
0.20	85	1.40	840	2.60	2,010	3.80	3,480
0.30	120	1.50	925	2.70	2,120	3.90	3,615
0.40	160	1.60	1,015	2.80	2,235	4.00	3,750
0.50	205	1.70	1,105	2.90	2,350	5.00	5,100
0.60	256	1.80	1,195	3.00	2,470	6.00	6,450
0.70	313	1.90	1,290	3.10	2,590	7.00	7,800
0.80	376	2.00	1,385	3.20	2,710	8.00	9,150
0.90	445	2.10	1,485	3.30	2,830	9.00	10,500
1.00	520	2.20	1,585	3.40	2,955	10.00	11,850
1.10	595	2.30	1,690	3.50	3,080	11.00	13,200
1.20	675	2.40	1,795	3.60	3,210		

JANUARY 1 TO DECEMBER 31, 1906.[b]

−.10	77	0.20	133	0.50	233	0.80	395
0.00	92	0.30	160	0.60	280	0.90	455
0.10	110	0.40	193	0.70	335	1.00	520

This table is applicable only for open-channel conditions. It is based on 14 discharge measurements ie during 1902–1905. It is well defined below gage height 5.0 feet. Above gage height 3.6 feet the ng curve is a tangent, the difference being 135 per tenth.

This table is applicable only for open-channel conditions. The rating is the same as the 1905 rating ve gage height 1 foot. Below 1 foot it is based primarily on tl e measurement made in 1906, and prob- r represents closely the conditions of flow as they existed during that year.

Monthly discharge of Carrabassett River at North Anson.

[Drainage area, 340 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1902.[a]					
June 26–30	4,965	1,105	3,015	8.87	
July	1,295	205	435	1.28	
August	6,990	120	738	2.17	
September	2,235	313	694	2.04	
October	4,155	376	762	2.24	
November	1,105	520	668	1.96	
December 1–12	675	445	565	1.66	
1903.[b]					
April	3,750	840	1,693	4.98	
May	1,290	85	492	1.45	
June	13,340	55	1,332	3.92	
July	2,350	160	483	1.42	
August	1,105	160	360	1.06	
September	205	55	110	.324	
October	755	55	200	.588	
November	595	85	161	.474	
December [c]	2,010	120	764	2.25	
1904.[d]					
April 10–30	7,935	1,015	2,911	8.56	
May	13,670	520	3,556	10.46	
June	1,690	55	395	1.16	
July	1,690	85	425	1.25	
August	2,120	160	396	1.14	
September	2,235	120	362	1.06	
October	1,900	160	652	1.92	
November	675	256	419	1.23	
December	595	256	367	1.08	
1905.[e]					
April	3,750	755	1,814	5.34	
May	3,210	595	1,316	3.87	
June	3,490	256	789	2.32	
July	2,120	120	459	1.35	
August	2,350	120	343	1.01	
September	1,585	120	490	1.44	
October	520	120	205	.602	
November	595	160	354	1.04	
December	840	256	404	1.19	
1906.[f]					
April	5,775	1,690	2,976	8.75	
May	3,885	755	1,962	5.77	
June	1,690	160	708	2.08	
July	1,105	160	389	1.14	
August	1,105	92	215	.632	
September	280	77	119	.350	
October	3,750	92	774	2.28	
November	840	233	408	1.20	
December	1,485	193	759	2.23	

[a] River frozen December 13–31, 1902.
[b] River frozen January 1 to March 29 and December 31, 1903.
[c] No correction made for ice conditions December 31, 1903.
[d] River frozen January 1 to April 9, 1904.
[e] River frozen January 1 to March 26, 1905.
[f] River frozen January 1 to April 16, 1906; open-channel rating applied for first half of April v gives excessive values for that month.

SANDY RIVER NEAR MADISON.

Sandy River rises near Rangeley Lake, flowing at first southe ward, then in the last third of its course northeastward into Kenn River, which it joins about 2 miles below Madison. It has a t length of about 50 miles, and while there are a few small ponds i basin its storage capacity is small and the flow is variable. It res *bles very much* in this way Carrabassett River, the slopes bein

he main steep and the fall very rapid throughout the greater part of ts course, amounting in all to as much as 1,400 feet. Comparatively ew water-power developments have been made; namely, at New haron, Farmington, and at the point near Madison described below.

This station was established March 23, 1904, by F. E. Pressey. t is located at the dam of the Madison Electric Works, just over the own line in Stark, but is nearer the Madison post-office. The dam ests on ledge rock and has a fairly level crest, 341.4 feet in length etween vertical abutments. The crest is 1 foot wide on top, sloping rom the upstream edge 4.75 horizontal to 1.25 vertical, while the lownstream face of the dam is vertical. The level top is of dressed tone (6-cut); the remainder is quarry faced, but care has been taken o leave no considerable projection on the approach to the crest. Provision has been made for the installation of flashboards when ecessary. The head developed by the dam is about 15 feet, which s used in a power development on the right bank, consisting of a ead bay nearly 100 feet long, decreasing in width from 40 to 20 feet t the racks, and one pair of 38-inch McCormick turbines (rated at Holyoke), with complete arrangements for a second pair if found ecessary. This plant is owned by the Madison village corporation nd is used for furnishing light and power. The pondage extends back bout 2 miles, but there is no side flowage. When water is more han 3 feet deep on the dam, the crest is increased in length about 87.5 eet by flowing over the wall of the fore bay. The wheels and gen- rators are in operation only during the night, so that the discharge as been based on a gage height read late in the afternoon just before tarting up; and it is believed that the pondage effect has been wholly liminated in this way.

A plain vertical staff gage was first fastened to the retaining wall f the dam, the elevation of the 100-foot mark at the gage being equal o the elevation of the crest of the dam. This has been superseded, owever, by a float gage referred to the same datum and installed hrough the courtesy and assistance of C. S. Humphreys, C. E., of Madison, engineer in charge. At the same time another float gage as placed to record the height of water in the tailrace, so that in ase it becomes necessary to use turbines in estimating flow records f the head on the wheels may be obtained. The gages are referred o the following bench mark: A point inclosed by a circle on the north ide of the wing wall, about 22.8 feet from its end at the dam, marked 'B. M."; elevation 102.98 feet above gage datum. The gages are ead twice daily by Marcus W. Moore, electrician at the station.

Where the discharge is under about 500 second-feet, values may be n error from 10 to 25 per cent; above 500 second-feet discharge, error s probably under 10 per cent.

Daily discharge, in second-feet, of Sandy River near Madison.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1904.											
1				2,677	9,255	516	334	235	126	1,135	67
2				2,216	5,785	452	289	357	126	720	46
3				2,216	4,336	452	516	334	92	502	46
4				1,986	4,063	452	452	312	106	502	46
5				2,216	3,280	391	334	135	126	379	39
6				3,792	2,331	452	235	135	152	306	35
7				4,199	1,441	1,004	235	213	106	256	32
8				3,531	2,331	974	181	135	79	278	32
9				8,875	2,101	735	235	135	92	403	3
10				11,265	8,499	585	235	135	92	224	3
11				8,126	8,667	452	181	135	60	278	3
12				5,936	5,485	334	235	391	60	224	
13				4,199	3,056	391	235	213	42	256	
14				3,056	2,331	391	235	256	79	300	
15				2,446	1,986	452	289	312	379	323	
16				2,101	10,325	334	289	235	1,101	323	
17				1,757	5,785	289	235	181	645	224	
18				2,331	3,280	289	235	181	379	224	
19				2,677	4,609	235	235	181	306	224	
20				4,609	6,402	135	235	135	323	224	
21				3,792	3,531	135	181	1,871	323	300	
22				3,926	2,446	135	181	923	379	4,309	
23			890	4,609	1,871	135	181	615	300	1,561	
24			1,250	5,485	1,648	135	181	477	256	923	
25			1,871	7,411	1,441	66	181	357	256	739	
26			3,059	6,402	974	135	135	357	357	720	
27			5,335	6,725	974	135	66	289	300	1,518	
28			3,792	6,090	812	135	135	135	300	1,137	
29			2,677	10,850	812	135	135	256	300	675	
30			2,331	10,237	585	135	152	152	956	615	
31			2,331	.....	516	.....	289	192	.....	502	
1905.											
1	224	379	a 150	7,026	1,364	477	323	2,078	136	57	
2	224	525	b 253	4,036	1,325	440	379	645	42	79	
3	256	570	b 253	3,012	874	502	2,653	502	51	47	
4	323	570	b 200	2,653	2,538	502	956	323	362	51	
5	403	645	b 215	2,308	2,607	403	645	224	929	59	
6	502	502	b 185	4,581	1,691	403	570	170	1,308	43	
7	502	502	b 253	4,775	1,734	615	403	170	836	47	
8	525	502	b 149	3,155	1,848	477	300	170	428	41	
9	645	379	a 112	2,423	1,561	379	256	192	285	41	
10	675	323	c 128	2,469	1,757	323	224	170	109	42	
11	766	278	c 168	3,031	1,364	224	170	92	145	37	
12	766	300	c 208	2,892	1,137	403	170	106	119	48	
13	645	224	c 242	2,940	992	3,330	170	106	163	253	
14	720	256	c 302	2,538	956	1,734	152	79	229	339	
15	570	323	c 284	2,653	956	956	152	126	166	153	
16	570	323	c 242	2,078	1,137	675	126	192	106	150	
17	570	256	c 208	1,734	1,848	477	126	300	76	131	
18	556	224	c 168	1,325	2,078	403	126	357	318	92	
19	542	278	192	1,137	2,892	357	106	170	1,601	83	
20	528	278	357	1,046	1,917	357	106	106	806	87	
21	514	a 139	440	1,175	1,479	403	126	106	563	94	
22	502	a 162	956	4,718	1,137	525	79	106	502	135	
23	525	a 128	956	2,377	956	477	79	79	417	116	
24	403	a 150	797	1,734	797	403	79	79	166	93	
25	379	a 139	874	1,518	645	278	79	60	156	92	
26	357	a 146	2,940	1,421	675	323	79	60	115	80	
27	379	a 112	5,665	1,561	645	1,691	79	60	103	69	
28	323	a 162	5,545	1,561	874	1,046	60	42	92	62	
29	256	.....	7,479	1,561	615	675	79	42	94	51	
30	224	.....	6,694	1,287	477	477	60	42	82	47	
31	874	.....	7,908	.....	525	.....	126	42	.....	45	

a Water flowing over one-half of dam on account of obstruction by ice.
b Water flowing over one-third of dam on account of obstruction by ice.
c Water flowing over three-fourths of dam on account of obstruction by ice.

Daily discharge, in second-feet, of Sandy River near Madison—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
1	231	539	593	1,223	2,458	2,478	.....	.....	.....	.....	244	396
2	231	467	595	1,292	2,761	2,353	.....	.....	.....	.....	266	194
3	200	374	517	1,050	2,252	3,747	.....	.....	.....	.....	312	246
4	229	372	363	1,141	2,252	3,203	.....	.....	.....	.....	397	339
5	263	361	444	1,711	1,609	2,312	.....	.....	.....	.....	322	304
6	286	407	360	2,882	2,974	2,166	.....	.....	.....	.....	243	279
7	236	491	339	2,985	2,901	3,219	.....	.....	.....	.....	206	359
8	286	595	326	2,243	2,741	2,994	.....	.....	.....	.....	213	373
9	373	555	303	2,371	2,607	3,331	.....	.....	.....	.....	213	393
10	429	564	321	2,280	4,050	2,788	.....	.....	.....	346	256	270
11	304	478	182	1,727	3,584	2,520	.....	.....	.....	933	329	304
12	351	565	294	1,748	2,780	2,067	.....	.....	.....	516	295	304
13	339	698	229	1,862	2,576	1,536	.....	.....	.....	310	311	339
14	294	582	406	2,813	2,830	1,202	.....	.....	.....	216	334	304
15	229	442	453	6,018	2,124	906	.....	.....	.....	140	300	281
16	317	373	384	8,844	1,757	688	.....	.....	.....	127	300	324
17	491	296	320	8,497	1,629	656	.....	.....	.....	113	369	259
18	555	208	222	7,304	1,902	601	.....	.....	.....	99	381	282
19	530	274	252	6,312	2,246	601	.....	.....	.....	91	492	271
20	469	273	262	5,972	1,720	594	.....	.....	.....	108	983	222
21	418	274	192	4,954	1,502	497	.....	.....	.....	204	919	260
22	406	294	183	5,791	1,174	638	.....	.....	.....	264	743	489
23	715	327	159	4,840	974	1,556	.....	.....	.....	169	871	591
24	2,655	419	166	3,319	868	4,212	.....	.....	.....	154	635	482
25	2,540	423	144	2,620	944	3,089	.....	.....	.....	368	477	544
26	1,736	361	191	2,574	565	2,355	.....	.....	.....	1,614	479	459
27	1,505	442	252	2,274	4,280	1,338	.....	.....	.....	806	667	435
28	1,000	504	443	2,321	4,787	890	.....	.....	.....	804	563	405
29	732	.....	1,070	2,503	5,062	677	.....	.....	.....	711	428	353
30	627	.....	1,388	2,504	3,611	608	.....	.....	.....	516	303	350
31	567	.....	1,406	.....	2,607	.....	.....	.....	.....	335	.....	306

NOTE.—July 1 to October 9, 1906, repairs of dam and construction of a log way were in progress and no records of flow are available.

Monthly discharge of Sandy River near Madison.

[Drainage area, 650 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
March 23–31	5,335	890	2,682	4.12	1.38
April	11,285	1,757	4,858	7.47	8.33
May	10,325	516	3,580	5.51	6.35
June	1,064	66	355	.546	.61
July	516	66	234	.360	.42
August	1,871	135	322	.495	.57
September	1,101	42	273	.420	.47
October	4,300	224	654	1.01	1.16
November	675	224	410	.631	.70
December	440	170	299	.460	.53
1905.[a]					
January	874	224	492	.757	.87
February	645	112	313	.482	.50
March	7,908	112	1,436	2.21	2.55
April	7,026	1,046	2,558	3.94	4.40
May	2,892	477	1,336	2.06	2.37
June	3,330	224	658	1.01	1.13
July	2,653	60	292	.449	.52
August	2,078	0	224	.345	.40
September	1,601	42	350	.538	.60
October	339	37	89	.137	.16
November	388	49	215	.331	.37
December	898	165	327	.503	.58
The year	7,908	0	691	1.06	14.45

[a] After August 31, 1905, wheels were run both day and night, and values are based on both the flow over the dam and through the wheels. Gage readings and gate openings read five times daily until April 8, 1906, since when four daily readings have been made.

Monthly discharge of Sandy River near Madison—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1906.					
January	2,655	200	630	0.969	1.12
February[a]	698	208	427	.657	.68
March[a]	1,406	144	412	.634	.73
April	8,844	1,050	3,466	5.33	5.95
May[b]	5,082	565	2,456	3.78	4.36
June[b]	4,212	497	1,863	2.87	3.20
October 10–31	1,614	91	407	.626	.47
November	983	206	429	.660	.74
December	591	194	346	.532	.61

[a] During February and March, 1906, values of flow may be as much as 25 per cent too large, owing to accumulations of ice on the crest of the dam.
[b] From May 5 to July 1, 1906, 1.33 foot flashboards were used for two-thirds the length of the dam.

MESSALONSKEE STREAM AT WATERVILLE.

Messalonskee Stream enters the Kennebec from the west at Waterville. It has a total drainage area of 208 square miles, of which 30 square miles are lake surface, which renders its flow very constant and gives it considerable value for power. Of this system Messalonskee Lake is nearest to the mouth of the river. In this lower portion of the river, about 10 miles in length, there is a fall of about 210 feet, which is practically all utilized.

The United States Geological Survey maintained a gage at the dam of the Chase Manufacturing Company, in Waterville, from June 18, 1903, to January 1, 1906. A vertical staff gage is fastened to the wall of the wheel pit just above the dam. The zero of the gage corresponds to the level of the crest of the dam and is referred to a bench mark as follows: A copper bolt in a ledge on the opposite side of the river from the gage and about 20 feet from the end of the dam; elevation, 11.51 feet above the crest of the dam. The dam is a new crib without leakage and with a good crest. Generally the water is not used for power purposes at night, and the gage is read while the wheels are not running. At other times the amount of water used through the wheels is added to that which flows over the dam. Flashboards are maintained during low stages of the river.

For medium and high stages values of flow are probably not in error more than 10 to 15 per cent. For low stages they may be 25 per cent or more in error. Conditions at this station have been poor for records, owing to frequent change of gage readers and effect of pondage during low water.

Daily discharge, in second-feet, of Messalonskee Stream at Waterville.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.												
							183	148	119	59	60	59
							220	112	129	59	49	59
							205	176	119	70	59	59
							148	212	119	61	57	59
							159	231	89	81	66	61
							169	205	112	54	70	33
							169	205	138	59	73	19
							176	183	111	51	61	51
							127	127	111	66	66	59
							159	212	104	36	59	59
							142	205	104	94	66	59
							127	194	84	94	73	145
							169	183	89	81	59	100
							142	194	89	70	19	51
							142	176	111	81	41	54
							148	112	111	75	73	51
							243	138	111	73	59	59
						212	231	176	99	60	59	54
						194	159	182	84	41	59	17
						169	194	182	48	73	59	157
						136	194	199	112	73	66	306
						169	194	159	212	73	61	291
						183	293	183	220	73	59	167
						183	314	118	19	70	59	252
						169	194	138	26	47	59	72
						176	169	138	41	81	59	72
						148	159	129	66	73	59	72
						118	176	119	94	73	73	53
						142	176	89	73	73	54	45
						176	209	106	59	66	76	59
							176	124	.....	41	.....	112
1904.												
				408			273	126	105	149	118	118
				336			314	149	113	118	118	118
				292			273	134	118	105	113	126
				360			251	144	96	90	118	77
				432			229	149	90	96	126	64
				533			251	157	105	105	105	69
				559			273	85	113	90	113	64
				533		408	273	118	118	90	85	59
				615		383	284	126	118	77	77	77
				899		314	212	126	126	85	85	90
				840		292	149	134	77	90	64	64
				840		336	244	126	77	90	69	77
			205	870		212	177	134	96	96	85	90
			360	811		292	251	113	96	90	105	64
			336	724		251	251	85	118	90	105	64
			301	642		205	[a] 64	118	218	64	90	77
			284	559		251	105	126	149	64	90	54
			351	615		212	134	134	118	69	85	64
			273	642		183	157	126	105	64	85	54
			230	642		193	134	134	118	85	90	64
			260	642		205	200	200	105	64	90	41
			273	.....		193	185	126	90	134	96	54
			587	.....		177	157	144	85	200	105	41
			724	.....		273	134	126	90	134	105	41
			724	.....		251	118	126	90	118	118	105
			697	.....		299	157	126	96	105	126	90
			507	.....		244	149	134	64	118	113	77
			383	.....		244	167	90	69	134	90	46
			360	.....		251	185	126	105	118	77	54
			408	.....		251	157	126	90	118	85	64
			432	.....		.....	105	96	.....	118	.....	64

[a] Twelve-inch flashboards on from July 16 to December 31, 1904.

Daily discharge, in second-feet, of Messalonskee Stream at Waterville—Continu

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1905.											
1	432	395	383	697	336	212	64	90	90	.....	118
2	408	360	360	668	314	251	.....	90	90	118	28
3	432	251	336	587	292	273	.....	118	.....	.....	134
4	434	314	336	507	336	212	.....	118	118	.....	149
5	432	360	472	533	251	193	.....	118	90	.....	.....
6	383	292	457	587	314	230	.....	.....	90	.....	.....
7	395	292	533	533	212	177	.....	118	118	.....	.....
8	642	273	507	543	230	212	.....	118	64	.....	.....
9	482	301	577	577	251	177	.....	90	64	118	.....
10	432	336	587	432	301	159	.....	90	.....	118	.....
11	432	348	550	472	260	111	.....	90	90	149	.....
12	408	432	615	482	336	144	.....	90	90	149	.....
13	383	360	482	457	336	144	90	.....	118	118	.....
14	408	314	507	408	360	149	77	90	118	118	.....
15	408	336	432	383	383	111	90	90	118	.....	.....
16	383	336	383	383	383	144	.....	90	90	118	.....
17	408	360	432	408	432	177	90	90	.....	149	.....
18	422	336	383	383	408	212	90	118	90	118	.....
19	482	432	587	422	432	177	90	118	105	149	.....
20	472	360	587	383	533	212	105	.....	64	149	.....
21	432	336	533	432	314	193	90	90	69	118	.....
22	432	348	482	507	273	183	90	90	90	.....	.....
23	422	360	507	408	251	177	.....	90	90	134	.....
24	434	383	472	383	212	193	118	90	.....	149	.....
25	482	336	482	360	212	177	118	90	90	134	.....
26	472	383	995	383	251	177	90	90	118	118	.....
27	482	360	870	395	212	a 64	90	.....	118	149	.....
28	482	336	753	336	432	54	118	90	105	149	.....
29	422	.....	811	336	383	54	118	90	118	.....	.....
30	434	.....	753	360	251	26	.....	64	118	149	.....
31	395	.....	697	.....	314	.....	149	90	.....	149	.....

a Twelve-inch flashboards on from June 27 to November 4, 1905. Figures for discharge are p
unreliable after about June 1, owing to insufficient data.

Monthly discharge of Messalonskee Stream at Waterville.

[Drainage area, 205 square miles.]

Month.	Discharge in second-feet.			Run-off	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	D i
1903.					
June 18-30	212	118	167	0.815	
July	314	127	183	.893	
August	231	89	163	.795	
September	220	19	100	.488	
October	94	36	67.1	.327	
November	76	19	60.4	.295	
December	306	17	89.2	.435	
1904.					
March 13-31	724	205	400	1.95	
April 1-21	599	292	609	2.97	
June 8-30	408	177	254	1.24	
July	314	64	194	.946	
August	200	85	128	.624	
September	218	64	105	.512	
October	200	64	102	.498	
November	126	64	97.7	.477	
December	126	41	71.3	.348	
1905.					
January	642	383	438	2.14	
February	432	251	344	1.68	
March	995	336	544	2.65	
April	697	336	458	2.23	
May	533	212	316	1.54	
June	273	26	166	.810	

COBBOSSEECONTEE STREAM AT GARDINER.

Cobbosseecontee Stream drains a group of lakes lying from 5 to 15 miles west from Augusta. The largest of these, Cobbosseecontee Pond, has an area of 8.4 square miles, and the aggregate area of all the ponds is about 19 square miles. The Cobbosseecontee empties into the Kennebec at Gardiner, about 6 miles below Augusta, and has a total drainage area of about 240 square miles. From the ordinary surface of Lake Maranacook, one of the upper lakes, to mean tide level at the mouth of the river the fall is 206 feet. In the lower three-fourths of a mile of the river there are seven dams, affording a total fall of about 128 feet. The uppermost of these dams is controlled by the Gardiner Water Power Company, the power being used to pump the Gardiner municipal water supply directly from the river. Records of the flow at this plant have been kept since 1890.

The dam is of stone masonry, with a timber apron at the toe. The downstream face has an approximate slope of 1 horizontal to 4 vertical. The crest is horizontal and is about 6 feet wide. The upstream slope is about 1 vertical to 8 horizontal. The total length of the dam is about 100 feet, and flashboards 4.5 feet high are maintained continuously. The total head obtained is about 10 feet. The head-bay entrance is on the right bank, and from this runs a wooden penstock in which is placed a 39-inch Hercules wheel. In the head bay there is also a gatehouse with two gates which are kept partially open most of the time to regulate the proper flow down the river.

The records of flow are made up by considering (1) the flow over the dam, which is nothing except usually for a short time in the spring; (2) the flow through the sluice gates, which is regulated by means of tables drawn up for the company by Hiram F. Mills, C. E., showing the discharge through the two gates for different pond levels, the practical application of this method being to obtain a given flow at any time by setting these gates at the required gate opening, the flow through the wheel being taken into account; (3) the amount of water flowing through the 39-inch wheel, which is ascertained from this gate opening and pond level by means of a table also provided for this purpose by Mr. Mills. The water that is pumped for the Gardiner supply is neglected in computations, being but a small percentage of the flow. It is also assumed that the tail water level remains constant. The leakage by the dam was measured during 1905 and found to be 10 second-feet, and correction made accordingly. No correction for leakage has been made previous to 1905. On Sundays and legal holidays gates are closed and no water is allowed to run unless the lake is full. The flow during low-water periods of certain years before 1899 has not been previously estimated, although a record of pond level and of flow through the wheel was kept for these times. In the accompa*nying revised estimates the flow* during these periods has been com-

puted. Under such conditions the pond level was
of the sluice gates and the discharge has been based
$Q = 2.70\ b\ H^{\frac{3}{2}}$, b being corrected for four end contra
tracting 0.4 H.

It is considered that the values of flow at this point
correct within 5 per cent. The very low water values n
as much as 10 per cent or more.

These records have been furnished the Survey by S.
Co., through their engineer, A. H. Twombley, up to 1
that time through Joseph A. Warren.

The Cobbosseecontee is a most remarkable exampl
larity of flow that can be obtained with proper storage.

Daily discharge, in second-feet, of Cobbosseecontee Stream at reservoir da

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1896.									
1							300	290	290
2							300	290	290
3							300	0	290
4							0	290	290
5							306	290	290
6							326	290	290
7							356	290	0
8							374	290	290
9							374	290	290
10							340	0	290
11							314	290	290
12							306	290	290
13							156	290	290
14							300	290	0
15							300	290	290
16						340	300	290	290
17						356	300	0	290
18						356	.....	290	290
19						356	.....	290	290
20						340	290	290	290
21						326	290	290	290
22						0	290	290	290
23						300	290	290	290
24						300	290	34	290
25						306	290	290	290
26						314	290	290	290
27						314	0	290	290
28						306	290	290	0
29						0	290	290	290
30						300	290	290	290
31						.....	290	0	.....
1897.									
1	290	290	290	2,160	300	300	300	290	285
2	290	274	274	2,114	300	300	300	0	285
3	290	270	270	2,070	0	300	300	285	280
4	290	270	270	2,070	300	300	0	285	280
5	290	182	304	2,070	300	300	0	285	280
6	290	120	347	1,940	300	300	300	285	0
7	290	300	340	1,836	300	0	300	290	290
8	290	.....	340	1,782	300	300	300	290	290
9	290	357	315	1,728	300	300	300	0	290
10	290	455	340	1,767	0	300	300	285	290
11	0	458	714	1,495	300	300	300	285	290
12	300	458	467	1,514	300	300	0	285	270
13	300	458	467	1,514	300	300	290	285	0
14	300	348	1,901	1,395	0	0	290	285	270
15	300	329	1,755	1,225	300	300	290	285	270

charge, in second-feet, of Cobbosseecontee Stream at reservoir dam at Gardiner— Continued.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
.....	300	590	1,573	1,270	300	300	290	0	270	250	107	161
.....	300	602	1,364	1,318	0	300	290	285	270	250	99	149
.....	300	574	1,286	1,318	300	300	290	285	270	0	90	135
.....	300	516	1,241	1,318	300	300	0	285	270	220	90	125
.....	300	516	1,204	1,318	306	300	.....	285	0	220	80	0
.....	300	483	1,167	1,273	314	0	290	285	270	220	28	166
.....	300	483	1,531	1,050	316	300	290	285	270	220	0	144
.....	503	363	2,199	1,013	300	300	290	0	270	220	88	220
.....	1,120	363	2,365	300	0	300	290	285	260	220	88	220
.....	1,100	393	2,365	300	300	300	290	285	260	0	92	20
.....	1,063	620	2,585	314	300	300	0	285	260	220	0	20
.....	1,063	942	2,531	306	300	300	290	285	0	166	157	20
.....	1,063	907	2,344	306	300	0	290	285	260	139	146	220
.....	1,063	.....	2,344	300	300	300	290	285	260	134	0	220
.....	1,079	.....	2,344	300	300	300	290	0	260	134	201	220
.....	1,001	.....	2,295	.....	0	.....	290	285	.....	108	.....	220
.....	220	270	280	280	0	280	280	280	280	280	280	280
.....	220	270	280	280	280	280	280	280	280	0	280	280
.....	0	270	280	0	280	280	0	280	280	280	280	280
.....	220	280	280	280	280	280	0	280	0	280	280	0
.....	250	280	280	280	280	0	280	280	280	280	280	280
.....	250	280	0	294	280	280	280	280	280	280	0	280
.....	250	0	280	294	280	280	280	0	280	280	280	280
.....	250	280	280	294	0	280	280	280	280	280	280	280
.....	250	280	280	286	280	280	280	280	280	0	280	280
.....	0	280	280	0	280	280	280	280	280	280	280	280
.....	250	280	280	306	280	280	0	280	0	280	280	0
.....	250	280	280	294	280	0	0	280	280	280	280	280
.....	250	280	0	280	280	280	0	280	280	280	0	280
.....	250	0	280	280	280	280	0	0	280	280	280	280
.....	270	280	280	280	0	280	0	280	280	280	280	280
.....	270	280	280	280	280	280	0	280	280	280	280	280
.....	0	280	280	0	280	280	0	280	280	280	280	280
.....	270	280	280	280	280	0	280	280	0	280	280	0
.....	270	280	280	280	280	0	280	280	280	280	280	280
.....	276	280	0	280	280	280	280	280	280	280	0	280
.....	276	0	280	280	280	280	280	0	280	280	280	280
.....	270	280	280	280	280	280	280	280	280	280	280	280
.....	270	280	280	280	280	280	280	280	280	0	280	280
.....	0	280	280	0	280	280	0	280	280	280	0	280
.....	270	280	280	280	280	280	280	280	0	280	280	0
.....	270	280	280	280	280	0	280	280	280	280	280	280
.....	270	0	280	280	280	280	280	0	280	280	280	280
.....	270	280	280	280	280	280	280	280	280	280	280	280
.....	270	.....	280	280	280	280	280	280	280	0	280	280
.....	0	.....	280	.....	280	.....	0	280	.....	280	.....	280
.....	0	280	280	535	435	300	280	280	68	0	250	220
.....	280	280	280	314	458	300	0	280	63	250	250	220
.....	280	280	280	300	509	300	280	280	0	250	250	0
.....	280	280	280	300	586	0	0	280	270	250	250	220
.....	280	280	0	300	1,079	300	280	280	199	220	0	220
.....	280	280	280	300	1,295	300	280	0	205	192	220	220
.....	280	280	280	300	1,179	300	280	280	201	183	220	220
.....	0	280	280	300	985	300	280	270	205	0	220	220
.....	280	280	280	0	713	300	0	270	270	220	220	220
.....	280	280	280	300	620	300	280	270	0	220	220	0
.....	280	280	280	314	500	0	280	270	270	220	220	220
.....	280	0	0	481	562	280	280	270	270	220	0	220
.....	280	280	280	682	502	280	280	0	270	174	220	220
.....	280	280	500	650	887	280	280	270	270	170	220	220
.....	0	280	620	650	1,202	280	280	270	199	0	220	220
.....	280	280	620	1,040	1,354	280	0	270	188	220	220	220
.....	280	280	535	1,079	1,552	280	280	270	0	220	220	0
.....	280	280	509	1,001	2,680	0	280	270	270	220	220	220
.....	280	0	458	962	2,481	280	280	270	270	185	0	220
.....	280	280	435	925	2,002	280	280	0	270	185	220	220

Daily discharge, in second-feet, of Cobbosseecontee Stream at reservoir dam.
Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1893.									
21	280	280	383	887	1,900	280	280	270	270
22	0	280	383	962	1,752	280	280	270	195
23	280	280	356	962	1,660	280	0	270	195
24	280	280	356	925	1,428	280	280	270	0
25	280	280	356	780	1,052	0	280	270	250
26	280	0	458	713	562	280	280	270	250
27	280	280	580	620	326	280	280	0	250
28	280	280	620	650	326	280	280	270	250
29	0	.....	562	620	326	280	280	270	250
30	280	.....	780	383	326	280	0	270	250
31	280	.....	620	.....	307	.....	280	270	.....
1894.									
1	280	280	225	0	300	325	280	280	280
2	280	280	220	314	300	382	280	280	0
3	280	280	220	314	300	574	280	280	280
4	280	0	0	306	280	326	0	280	280
5	280	280	220	306	280	326	280	280	280
6	280	280	220	306	0	326	280	280	280
7	0	280	220	306	280	326	280	280	270
8	280	280	220	26	280	326	280	280	270
9	280	280	220	326	280	326	280	0	270
10	280	280	220	314	280	300	280	280	270
11	280	0	0	314	280	326	280	280	270
12	280	280	276	314	280	314	280	0	270
13	280	280	483	314	0	300	280	280	270
14	0	280	483	314	280	300	280	280	270
15	280	280	426	0	280	280	0	280	270
16	280	280	426	430	280	280	280	280	0
17	280	280	410	430	280	280	280	280	270
18	280	0	405	430	280	280	280	280	270
19	280	280	405	314	280	280	280	0	270
20	280	280	690	314	0	280	280	280	270
21	0	280	300	314	280	280	280	280	270
22	280	280	287	26	280	280	0	280	270
23	280	280	382	326	280	280	280	280	0
24	280	280	300	314	280	280	280	280	270
25	280	0	11	314	280	280	280	280	270
26	280	280	314	300	326	280	280	0	270
27	280	280	314	300	523	280	280	280	270
28	0	280	314	300	490	280	280	280	270
29	280	.....	300	0	370	280	280	280	270
30	280	.....	300	300	523	280	280	280	270
31	280	.....	300	.....	862	.....	280	280	.....
1895.									
1	250	250	0	250	385	280	280	280	0
2	250	250	0	250	318	0	280	280	270
3	250	0	0	250	300	280	280	280	270
4	250	250	250	250	280	280	0	280	270
5	250	250	250	250	0	280	280	280	270
6	0	250	250	250	280	280	280	280	270
7	250	250	250	14	280	280	0	280	270
8	250	250	0	343	280	280	280	280	0
9	250	250	0	775	280	0	280	280	270
10	250	0	0	2,539	280	280	280	280	270
11	250	250	250	1,301	280	280	280	0	250
12	250	250	250	1,554	280	280	280	280	250
13	0	250	250	300	280	280	280	280	250
14	250	250	250	74	280	280	280	280	250
15	250	250	250	2,005	280	280	280	0	250
16	250	250	250	2,461	280	0	280	280	250
17	250	0	0	1,558	280	280	280	280	250
18	250	250	250	1,449	280	280	280	0	250
19	250	250	250	1,400	280	280	280	280	250
20	0	250	250	1,271	280	280	280	161	250
21	250	250	250	440	0	280	0	280	155
22	250	250	250	324	280	280	280	280	0
23	250	250	250	358	280	280	280	280	280
24	250	0	250	326	280	280	280	280	280
25	250	250	250	358	280	280	0	280	280

arge, in second-feet, of Cobbosseecontee Stream at reservoir dam at Gardiner—Continued.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
....	250	220	220	385	0	280	280	270	220	85	220	250
....	0	220	220	385	280	280	280	270	220	0	220	250
....	250	0	220	409	280	280	0	270	220	112	0	250
....	250	.....	220	409	280	280	280	270	0	88	220	14
....	250	.....	220	409	280	0	280	270	220	88	220	264
....	250	.....	0	.....	280	.....	280	270	.....	88	.....	343
....	0	270	0	901	300	280	280	280	250	250	0	250
....	451	0	1,959	993	300	280	280	0	250	250	220	250
....	276	270	2,608	901	0	280	280	280	250	250	220	250
....	264	270	1,959	856	300	280	0	280	250	0	220	250
....	0	.....	1,637	856	300	280	0	270	250	250	220	250
....	270	270	1,219	856	300	280	280	270	0	250	220	0
....	270	270	1,219	856	280	0	280	270	250	250	220	250
....	270	270	1,226	856	280	280	280	270	250	250	0	250
....	270	0	1,368	709	280	280	280	0	250	250	220	250
....	270	270	1,368	727	0	280	280	270	250	250	220	250
....	270	270	946	727	280	280	280	270	250	0	220	250
....	0	270	1,038	727	280	280	0	270	250	250	220	250
....	270	270	1,086	727	280	280	280	270	0	250	220	0
....	270	270	1,038	812	280	0	280	270	250	220	220	250
....	270	270	901	812	280	280	280	270	270	220	0	250
....	270	0	769	901	280	280	280	0	270	220	220	250
....	270	270	727	946	0	280	280	270	270	220	220	250
....	270	270	685	1,188	280	280	280	270	250	0	250	250
....	0	270	856	1,236	280	280	0	270	250	220	250	250
....	270	270	993	1,039	280	280	280	270	0	220	250	0
....	270	270	1,581	901	280	0	280	270	250	220	250	250
....	270	270	1,429	992	280	280	280	270	250	220	0	250
....	270	0	1,275	1,039	280	280	280	0	250	220	250	250
....	270	280	1,056	901	0	280	280	270	250	220	250	250
....	270	280	728	769	280	280	280	270	250	0	250	0
....	0	280	686	644	280	280	0	270	250	220	0	250
....	270	280	812	526	280	280	280	270	0	220	250	0
....	270	280	769	300	280	0	280	270	250	220	250	250
....	270	280	727	300	280	280	280	270	250	220	0	250
....	270	.....	644	300	0	280	280	0	250	220	250	250
....	270	.....	727	.....	0	.....	280	250	.....	220	.....	250
....	250	250	250	497	280	600	280	0	280	280	270	270
....	250	250	250	517	0	477	280	280	280	280	270	270
....	0	250	250	574	308	573	280	280	280	0	270	270
....	250	250	250	350	624	523	0	280	280	280	270	270
....	250	250	250	620	630	477	100	280	0	280	270	0
....	250	250	250	650	320	202	280	280	280	280	270	270
....	250	0	0	650	320	336	280	280	280	280	0	270
....	250	250	250	650	320	336	280	0	280	280	270	270
....	250	250	250	620	74	320	280	280	280	280	270	270
....	0	250	250	620	373	320	280	280	280	0	270	270
....	250	250	250	650	393	512	0	280	280	280	270	270
....	250	250	250	590	393	559	280	280	0	280	270	0
....	250	250	250	421	393	679	280	280	280	280	270	270
....	250	0	0	310	.....	679	280	280	280	270	0	270
....	250	250	250	356	489	436	280	0	280	157	270	270
....	250	250	250	522	244	354	280	280	280	121	270	270
....	0	250	250	497	509	320	280	280	280	0	270	270
....	250	250	250	497	833	294	0	280	280	174	270	280
....	250	250	250	473	709	286	280	280	0	163	270	0
....	250	250	250	453	739	6	280	280	280	152	270	280
....	250	0	0	320	709	286	280	280	280	136	0	280
....	250	250	250	294	391	436	280	0	280	174	270	280
....	250	250	250	286	6	654	280	280	280	185	270	280
....	0	250	250	280	280	365	280	280	280	0	270	280
....	250	250	250	14	280	294	0	280	280	270	270	21

Daily discharge, in second-feet, of Cobbosseecontee Stream at reservoir
Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept
1897.									
29	250	250	250	286	280	286	280	280	
30	250	250	250	280	280	0	280	280	
31	250	0	0	286	320	280	280	280	
1	250	.....	250	286	19	280	280	0	
2	250	.....	250	280	914	280	280	280	
3	0	.....	306	.....	772	.....	280	280	
1898.									
1	280	280	413	.....	478	280	280	280	
2	280	280	384	.....	478	280	280	280	
3	280	280	443	1,016	478	280	0	280	
4	280	280	408	1,038	455	280	19	280	
5	280	280	408	1,038	455	0	280	280	
6	280	0	387	1,038	433	280	280	280	
7	280	280	466	1,038	433	280	280	0	
8	280	280	529	1,038	273	280	280	280	
9	280	280	503	1,038	333	280	280	280	
10	280	280	474	1,003	333	280	0	280	
11	280	280	456	584	314	280	280	280	
12	280	280	559	531	300	0	280	280	
13	280	280	507	329	300	280	280	280	
14	280	280	821	329	300	280	280	0	
15	280	280	1,149	334	0	280	280	280	
16	0	300	1,111	376	300	280	280	270	
17	300	300	1,059	413	300	280	0	270	
18	300	300	909	433	300	280	280	270	
19	300	300	909	433	300	0	280	270	
20	300	300	1,016	433	300	280	280	270	
21	300	308	1,122	433	300	280	280	0	
22	300	333	1,124	433	0	280	280	270	
23	300	333	1,147	433	300	280	280	270	
24	300	445	1,222	433	300	280	0	270	
25	300	504	1,261	355	280	280	280	270	
26	300	467	1,122	478	280	0	280	270	
27	300	433	1,259	478	280	280	280	270	
28	300	433	1,147	478	280	280	280	0	
29	300	.....	1,124	478	280	280	280	270	
30	0	.....	1,147	620	280	280	280	270	
31	300	.....	1,147	.....	280	.....	0	270	
1899.									
1	0	250	250	300	300	280	280	280	
2	250	250	250	306	300	280	0	280	
3	250	250	250	306	300	280	280	280	
4	250	250	250	306	300	0	19	280	
5	250	0	250	350	300	280	280	280	
6	250	250	250	373	300	280	280	0	
7	250	250	250	365	0	280	280	280	
8	250	250	250	302	300	280	280	280	
9	250	250	250	812	300	280	0	280	
10	250	250	250	1,198	300	280	280	280	
11	250	250	250	1,222	300	0	280	280	
12	250	250	0	984	300	280	280	280	
13	250	250	250	772	300	280	280	0	
14	250	250	250	493	280	280	280	280	
15	0	250	250	499	280	280	280	280	
16	250	250	250	937	280	0	270	270	
17	250	250	250	1,047	280	280	270	270	
18	250	250	250	1,233	280	280	270	270	
19	250	250	0	1,367	280	280	270	270	
20	250	250	250	1,427	280	280	0	270	
21	250	250	250	1,403	280	280	270	270	
22	250	250	250	1,351	280	280	270	270	
23	250	250	250	1,145	280	0	270	270	
24	250	250	250	1,126	280	280	270	270	
25	250	250	250	870	280	280	270	0	
26	250	250	250	744	280	280	270	270	
27	250	250	250	744	280	280	270	270	
28	250	250	250	470	280	280	270	270	
29	250	.....	250	321	280	280	270	270	
30	250	.....	250	0	280	280	270	270	
31	250	.....	250	.....	280	.....	270	270	

Daily discharge, in second-feet, of Cobbosseecontee Stream at reservoir dam at Gardiner—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug	Sept.	Oct.	Nov.	Dec.
1900.												
1	130	220	815	776	300	300	0	260	260	230	180	220
2	130	220	1,463	495	300	300	280	260	0	220	165	0
3	130	220	2,316	417	300	0	280	260	260	190	140	220
4	125	0	2,055	656	413	300	0	260	260	175	0	220
5	125	220	1,911	977	803	280	280	0	240	175	130	220
6	125	220	1,622	907	934	280	280	260	240	150	130	220
7	0	220	1,481	1,087	831	280	280	260	240	0	130	220
8	130	220	1,295	1,379	606	280	0	260	240	160	130	220
9	110	220	1,155	1,380	456	280	280	260	0	175	200	0
10	100	220	1,155	1,342	413	0	280	260	240	180	220	220
11	90	0	1,153	1,297	348	280	280	260	240	190	0	220
12	90	220	1,116	1,297	300	280	280	0	240	220	220	240
13	90	220	1,037	1,297	0	280	280	260	235	220	220	240
14	0	2,194	999	1,297	300	280	280	260	230	0	220	230
15	100	1,573	999	1,297	300	280	0	260	230	220	220	230
16	95	1,283	999	1,213	300	280	280	260	0	220	220	0
17	90	856	1,615	1,105	300	0	280	260	250	220	220	240
18	90	562	1,611	1,072	300	280	280	260	250	220	0	240
19	90	425	1,473	1,260	300	280	280	0	250	220	220	240
20	90	294	1,518	1,380	585	280	280	260	250	220	220	240
21	0	270	1,811	1,338	704	280	280	275	245	0	220	240
22	140	270	1,662	1,260	998	280	0	275	250	220	220	240
23	160	270	1,517	1,223	1,325	280	280	275	0	220	220	0
24	200	270	1,472	1,223	1,422	0	280	275	250	220	220	240
25	200	0	1,334	1,182	1,301	280	270	275	250	220	0	0
26	200	564	1,289	869	1,016	280	260	0	250	220	220	240
27	200	662	1,206	570	456	280	260	275	250	220	220	240
28	0	776	1,206	377	357	280	260	275	245	0	220	240
29	220	.....	1,105	0	300	280	0	275	230	220	220	240
30	220	.....	1,015	300	300	280	260	260	0	220	220	0
31	220	.....	925	.....	300	.....	260	260	.....	200	.....	240
1901.												
1	240	220	120	535	260	510	280	280	0	270	250	0
2	240	220	120	439	260	483	280	280	280	270	250	220
3	250	0	0	646	260	439	280	280	280	250	0	220
4	250	220	120	1,439	260	303	0	0	280	250	250	220
5	250	220	120	2,118	0	303	280	280	280	250	250	220
6	0	220	120	2,343	260	304	280	280	280	0	250	220
7	250	220	120	2,089	260	300	0	280	280	250	250	220
8	250	220	120	3,111	280	300	280	280	0	250	250	0
9	250	220	120	3,205	280	280	280	280	280	250	250	220
10	250	0	0	3,050	280	280	280	280	280	250	0	220
11	240	200	130	2,872	280	280	280	0	280	250	250	220
12	240	200	170	2,649	0	280	280	280	280	250	250	220
13	0	200	200	2,580	280	280	280	280	280	0	250	220
14	220	200	220	2,534	280	280	0	280	270	250	250	220
15	220	180	220	2,339	280	280	280	280	0	250	250	0
16	220	180	220	2,213	280	0	280	280	270	250	250	2,700
17	220	0	0	2,089	280	280	280	280	270	250	0	2,600
18	220	125	220	2,034	280	280	280	0	270	250	250	1,143
19	220	125	220	1,921	0	280	280	280	270	250	250	999
20	0	125	220	1,756	280	280	280	280	270	0	250	270
21	220	125	220	1,143	280	280	0	280	270	250	250	270
22	220	125	250	999	280	280	280	280	0	250	250	0
23	220	125	250	1,194	280	0	280	280	270	250	250	270
24	220	0	0	1,296	280	280	280	280	270	250	0	270
25	220	125	276	1,194	280	280	280	0	270	250	250	270
26	220	125	524	1,046	26	280	280	280	270	250	250	270
27	0	120	919	907	286	280	280	280	270	0	220	270
28	220	120	1,404	1,109	286	280	0	280	270	250	0	270
29	220	.....	1,262	985	354	280	280	280	0	250	220	0
30	220	.....	824	260	393	0	280	280	270	250	220	284
31	220	.....	560	.....	483	.....	280	280	.....	250	.....	1,143
1902.												
1	500	463	2,400	1,803	713	0	280	280	280	280	270	270
2	348	280	2,400	1,748	713	280	280	280	280	280	0	270
3	294	280	2,222	1,593	650	280	280	0	280	280	270	270
4	280	280	1,702	1,540	566	280	20	280	280	280	270	270
5	0	280	1,583	1,390	514	280	21	280	280	0	270	270

Daily discharge, in second-feet, of Cobbosseecontee Stream at reservoir dam at
Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.										
6	280	280	1,370	1,071	465	280	0	280	280	
7	280	280	1,165	848	415	280	280	280	0	
8	280	280	1,017	280	393	0	280	280	280	
9	280	280	878	280	373	280	280	280	280	
10	280	280	878	354	306	280	280	0	280	
11	280	280	1,065	705	280	280	280	280	280	
12	0	280	1,114	819	280	280	280	280	280	
13	280	280	1,214	927	280	280	0	280	280	
14	280	280	1,267	900	280	280	280	280	0	
15	280	280	1,017	705	280	0	280	280	280	
16	280	280	746	584	280	280	280	280	280	
17	280	280	833	531	280	280	280	0	280	
18	280	280	1,423	465	0	280	280	280	280	
19	0	280	1,267	438	280	280	280	280	280	
20	280	280	1,531	438	280	280	0	280	280	
21	280	280	1,765	415	280	280	280	280	0	
22	280	280	1,702	369	280	0	280	280	280	
23	1,642	280	1,563	369	280	280	280	280	280	
24	1,446	280	1,478	345	280	280	280	0	280	
25	1,097	280	1,370	313	0	280	280	280	280	
26	924	280	1,267	313	280	280	280	280	280	
27	752	280	1,165	94	280	280	0	280	280	
28	776	280	1,017	367	280	280	280	280	0	
29	719	.....	789	367	280	0	280	280	280	
30	479	.....	1,531	350	280	280	280	280	280	
31	479	.....	1,531	.....	280	.....	280	0	.....	
1903.										
1	250	0	1,011	1,085	280	280	280	280	270	
2	250	270	1,011	1,054	280	280	280	0	270	
3	250	270	768	803	0	280	280	280	270	
4	0	270	663	846	280	280	0	280	270	
5	250	270	637	735	280	280	0	280	270	
6	250	270	564	735	280	280	280	280	0	
7	250	270	587	750	280	0	280	280	0	
8	250	0	848	645	280	280	280	280	270	
9	250	270	1,250	712	280	280	280	0	270	
10	250	270	1,815	712	0	280	280	280	270	
11	0	270	3,243	697	280	280	280	280	270	
12	250	270	3,275	0	280	280	280	0	270	
13	250	270	3,235	300	280	280	280	280	270	
14	250	270	3,216	300	280	0	280	280	0	
15	250	0	2,585	300	280	280	280	280	270	
16	250	270	2,497	300	280	280	280	280	270	
17	250	270	2,231	300	0	280	280	0	270	
18	0	270	1,976	300	280	280	280	280	270	
19	250	270	1,779	29	280	280	280	280	270	
20	250	270	1,479	326	280	280	0	280	270	
21	250	270	1,479	314	280	0	280	280	0	
22	250	14	1,479	306	280	280	280	280	270	
23	250	367	1,499	306	280	280	280	270	270	
24	250	450	1,722	300	280	280	280	0	250	
25	0	519	1,623	300	280	280	280	270	250	
26	270	776	1,066	0	280	280	280	270	250	
27	270	515	1,110	300	280	280	0	270	0	
28	270	489	1,136	300	280	0	280	270	250	
29	270	.....	1,111	300	280	280	280	270	250	
30	270	.....	882	300	280	280	280	0	250	
31	270	.....	906	.....	0	.....	280	270	.....	
1904.										
1	200	180	160	280	2,747	280				
2	200	180	160	280	2,437	280	280	265	265	
3	0	180	160	0	1,859	280	280	265	265	
4	200	180	200	280	725	280	280	265	265	
5	200	140	200	280	351	0	280	265	0	
6	200	180	0	286	283	280	280	265	265	
7	200	0	220	306	280	280	280	0	265	
8	200	160	250	286	283	280	280	265	265	
9	200	160	250	320	300	280	280	265	265	
10	0	160	280	532	956	280	0	265	265	

Daily discharge, in second-feet, of Cobbosseecontee Stream at reservoir dam at Gardiner—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.												
1	200	160	290	618	1,406	280	280	265	0	250	220	0
2	180	160	280	497	2,129	0	280	265	265	250	220	220
3	180	160	186	399	1,609	280	280	265	265	250	0	200
4	180	0	280	270	1,105	280	280	0	265	250	220	180
5	180	160	280	276	362	280	280	265	265	250	220	150
6	180	160	280	276	280	280	280	265	265	0	220	130
7	0	160	280	270	537	280	0	265	265	250	220	125
8	180	130	280	270	670	280	280	265	0	250	220	0
9	180	125	280	270	699	0	280	265	265	250	220	115
10	180	125	0	250	699	280	280	265	265	250	0	115
11	180	0	280	372	699	280	265	0	265	250	220	110
12	180	120	280	462	634	280	265	265	265	250	220	110
13	180	135	280	421	489	280	265	265	265	0	220	10
14	0	150	280	250	415	280	0	265	265	250	0	10
15	180	160	337	331	300	280	265	265	0	250	220	48
16	180	160	494	331	280	0	265	265	265	250	220	48
17	180	160	649	405	280	280	265	265	265	250	0	100
18	180	0	564	565	280	280	265	0	265	250	220	100
19	180	160	529	2,652	0	280	265	265	265	250	220	100
20	180	.....	329	2,747	280	280	265	265	0	200	220	100
21	0	.....	280	.....	280	.....	.....	265	.....	250	.....	100
1905.[a]												
1	10	160	160	565	280	285	280	260	220	10	115	180
2	115	160	150	605	280	285	10	260	220	220	115	180
3	115	160	140	453	280	285	280	260	10	220	115	10
4	115	160	140	330	280	10	145	260	220	220	115	180
5	115	30	60	340	285	285	135	260	220	220	10	180
6	115	160	130	568	285	285	260	10	220	220	180	195
7	115	160	130	882	10	280	260	260	220	220	180	195
8	10	160	125	703	285	280	260	260	220	10	180	195
9	160	160	115	530	285	280	10	260	220	220	180	195
10	160	160	120	400	285	280	260	260	10	220	180	10
11	160	160	125	290	285	10	260	260	220	220	180	195
12	160	20	35	290	285	280	260	260	220	220	10	195
13	160	160	125	290	285	280	260	10	220	220	180	195
14	160	160	115	290	10	280	260	260	220	220	180	195
15	10	160	110	290	285	280	260	260	220	10	180	195
16	160	160	105	113	285	280	10	260	220	220	180	195
17	160	160	105	290	285	280	260	260	10	220	180	10
18	160	160	100	290	285	10	260	260	220	220	180	195
19	160	25	20	290	285	280	260	260	220	220	10	195
20	160	160	160	290	285	280	260	10	220	220	180	195
21	160	160	170	290	10	280	260	260	220	220	180	195
22	10	160	200	290	285	280	260	260	220	10	180	195
23	160	160	210	10	285	280	10	260	220	220	180	195
24	160	160	210	290	285	280	260	260	10	220	180	10
25	160	160	210	290	285	10	260	260	220	210	180	25
26	160	20	10	290	285	280	260	260	220	190	10	195
27	160	160	260	290	285	280	260	10	220	170	180	195
28	160	160	260	280	10	280	260	220	220	160	180	195
29	20	.....	286	280	285	280	260	220	220	10	180	195
30	160	.....	484	10	10	280	10	220	220	115	10	195
31	160	.....	591	.....	285	.....	260	220	.....	115	.....	10
1906.[b]												
1	195	220	260	10	795	1,100	440	735	285	280	280	275
2	195	230	260	270	722	1,080	600	780	10	280	280	10
3	195	250	260	270	724	1,020	670	380	285	280	280	275
4	195	250	10	270	724	860	660	300	285	280	10	275
5	195	250	270	270	592	650	300	10	285	280	280	275
6	195	265	265	270	294	510	300	290	285	280	280	275
7	10	265	270	270	300	630	285	290	285	10	280	275
8	195	265	270	10	592	645	10	290	285	280	280	275
9	195	265	270	270	567	620	280	285	10	280	280	10
10	195	265	270	270	545	610	275	285	290	280	280	275

[a] Leakage of dam during 1905 taken at 10 second-feet, as determined by measurements during 1905.
[b] Leakage of dam during 1906 taken at 10 second-feet as determined by measurements during 1905.

Daily discharge, in second-feet, of Cobbosseecontee Stream at reservoir dam Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct
1906.										
11	195	10	10	610	535	585	275	285	290	2
12	195	265	270	625	381	460	275	10	290	2
13	195	265	270	625	320	350	275	285	240	2
14	10	265	270	625	290	346	275	285	290	1
15	210	265	270	625	290	310	10	285	290	2
16	210	265	270	1,010	290	290	275	285	10	2
17	210	280	270	1,049	285	16	275	285	290	2
18	210	10	10	757	280	290	275	285	290	2
19	210	280	270	516	280	290	275	10	290	2
20	210	280	270	547	10	280	275	285	290	2
21	10	280	270	677	280	280	275	290	290	1
22	210	280	270	800	280	280	10	290	290	2
23	210	280	270	800	280	280	275	290	10	2
24	303	270	270	800	280	260	720	290	280	2
25	303	10	10	1,040	275	985	910	290	280	2
26	284	260	270	1,026	275	1,280	880	10	280	2
27	284	260	270	1,051	10	1,100	760	290	280	2
28	250	260	270	1,061	310	980	450	290	280	1
29	236	.....	270	1,000	717	310	15	285	280	2
30	216	.....	270	867	970	324	400	285	10	2
31	210	.....	270	.....	1,110	.....	640	285	.....	2

Monthly discharge of Cobbosseecontee Stream at reservoir dam at Ga

[Drainage area, 240 square miles].

Month.	Discharge in second-feet.			Sec.-ft sq. m
	Maximum.	Minimum.	Mean.	
1890.				
June 16-30	356	0	281	1
July (29 days)	374	0	281	1
August	290	0	244	1
September	290	0	261	1
October	393	0	283	1
November	445	0	345	1
December	300	0	250	1
1891.				
January	1,120	0	483	2
February	912	0	556	2
March	2,585	515	1,385	5
April	2,169	300	1,277	5
May	316	0	253	1
June	300	0	260	1
July	300	0	246	1
August	290	0	240	1
September	285	0	236	.
October	260	0	194	.
November	201	0	80.3	.
December	220	0	147	.
The year	2,585	0	446	1
1892.				
January	276	0	216	.
February	280	0	240	1
March	280	0	241	1
April	306	0	246	1
May	280	0	253	1
June	280	0	233	.
July	280	0	181	.
August	280	0	244	1
September	280	0	243	1
October	280	0	235	.
November	280	0	233	.
December	280	0	244	1
The year				

[a] For thirty-one days.

discharge of Cobbosseecontee Stream at reservoir dam at Gardiner—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1893.					
	280	0	235	0.979	1.13
	280	0	250	1.04	1.08
	780	0	395	1.65	1.90
	1,079	0	608	2.53	2.82
	2,680	307	1,025	4.27	4.92
	300	0	249	1.04	1.16
	280	0	226	.942	1.00
	280	0	237	.988	1.14
r.	270	0	197	.821	.92
	250	0	179	.746	.86
r.	250	0	187	.779	.87
	220	0	177	.738	.85
year	2,680	0	330	1.38	18.74
1894.					
	220	0	192	.800	.92
	220	0	189	.788	.82
	900	0	341	1.42	1.64
	430	0	273	1.14	1.27
	862	0	304	1.27	1.46
	925	0	327	1.36	1.52
	280	0	226	.942	1.09
	280	0	244	1.02	1.18
r.	280	0	217	.904	1.01
	270	0	218	.908	1.05
r.	250	0	208	.867	.97
r.	250	0	202	.842	.97
year				1.02	13.90
1895.					
	250	0	218	.908	1.05
	250	0	183	.762	.79
	220	0	163	.679	.78
	2,619	14	773	.322	.36
	385	0	240	1.00	1.15
	280	0	233	.971	1.08
	280	0	235	.979	1.13
	280	0	238	.992	1.14
r.	270	0	200	.833	.93
	220	0	101	.421	.49
r.	220	0	144	.600	.67
r.	343	0	186	.775	.90
year				.77	10.47
1896.					
	451	0	232	.967	1.11
	280	0	235	.979	1.06
	2,698	0	1,101	4.59	5.29
	1,236	300	812	3.38	3.77
	300	0	229	.954	1.10
	280	0	243	1.01	1.13
	280	0	235	.979	1.13
	280	0	227	.946	1.09
er.	270	0	219	.912	1.02
	250	0	202	.842	.97
r.	250	0	186	.775	.86
r.	250	0	210	.875	1.01
year	2,698	0	344	1.43	19.55
1897.					
	250	0	210	.875	1.01
	550	0	225	.938	.98
	306	0	220	.917	1.06
	650	14	438	1.82	2.03
days)	914	0	411	1.71	[a] 1.97
	679	0	384	1.60	1.78
	280	0	238	.992	1.14
	280	0	235	.979	1.13
er.	280	0	243	1.01	1.13
	280	0	201	.838	.97
r.	270	0	234	.975	1.09
r.	280	0	231	.962	1.11
e year	914	0	272	1.15	15.40

[a] For 30 days.

Monthly discharge of Cobbosseecontee Stream at reservoir dam at Gardiner—Contin

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Dep in
1898.					
January	280	0	235	0.979	
February	504	0	301	1.25	
March	1,261	387	843	3.51	
April (28 days	1,038	0	300	2.46	
May	478	0	305	1.27	
June	280	0	243	1.01	
July	280	0	226	.942	
August	280	0	239	.996	
September	270	0	219	.913	
October	250	0	200	.833	
November	250	0	208	.867	
December	270	0	233	.971	
The year				1.33	
1899.					
January	270	0	226	.942	
February	270	0	231	.962	
March	280	0	235	.979	
April	1,427	0	776	3.23	
May	300	0	245	1.02	
June	280	0	243	1.01	
July	280	0	226	.942	
August	280	0	239	.996	
September	270	0	166	.692	
October	160	0	86.2	.359	
November	180	0	131	.546	
December	180	0	116	.483	
The year	1,427	0	243	1.01	
1900.					
January	220	0	119	.496	
February	2,194	0	453	1.89	
March	2,316	815	1,365	5.69	
April	1,380	0	964	4.02	
May	1,422	0	544	2.27	
June	300	0	245	1.02	
July	280	0	222	.925	
August	275	0	230	.958	
September	260	0	204	.850	
October	230	0	180	.750	
November	220	0	172	.717	
December	240	0	187	.779	
The year	2,316	0	407	1.70	
1901.					
January	250	0	201	.838	
February	220	0	149	.621	
March	1,404	0	299	1.25	
April	3,205	260	1,736	7.23	
May	483	0	254	1.06	
June	510	0	275	1.15	
July	280	0	235	.979	
August	280	0	244	1.02	
September	280	0	229	.954	
October	270	0	219	.912	
November	250	0	205	.854	
December	2,700	0	441	1.84	
The year	3,205	0	374	1.56	
1902.					
January	1,642	0	450	1.88	
February	463	280	287	1.20	
March	2,400	746	1,364	5.68	
April	1,803	94	691	2.88	
May	713	0	336	1.40	
June	280	0	233	.971	
July	280	0	227	.946	
August	280	0	235	.979	
September	280	0	2 3	1.01	
October	280	0	239	.996	
November	270	0	2?5	.938	
December	290	0	228	.950	
The year	2,400	0	396	1.65	

a For 30 days.

y discharge of Cobbosseecontee Stream at reservoir dam at Gardiner—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
	270	0	222	0.925	1.07
	776	0	286	1.19	1.24
	3,275	564	1,571	6.55	7.55
	1,085	0	455	1.90	2.12
	280	0	235	.979	1.13
	280	0	243	1.01	1.13
	280	0	235	.979	1.13
	270	0	232	.967	1.11
r	270	0	220	.917	1.02
	250	0	205	.854	.98
r	220	0	126	.525	.59
r	220	0	133	.554	.64
year	3,275	0	347	1.45	19.71
1904.					
	200	0	157	.654	.75
	180	0	136	.567	.61
	649	0	278	1.16	1.34
	2,747	0	493	2.05	2.29
	2,747	0	778	3.24	3.74
	280	0	243	1.01	1.13
	280	0	223	.929	1.07
r	265	0	231	.962	1.11
	265	0	221	.921	1.03
r	265	0	220	.917	1.06
r	250	0	188	.783	.87
r	220	0	136	.567	.65
year	2,747	0	275	1.15	15.66
1905.					
	160	10	127	.529	.61
	160	20	141	.588	.61
	591	10	166	.692	.80
	882	10	347	1.45	1.62
	285	10	240	1.00	1.15
	285	10	245	1.02	1.14
	280	10	213	.888	1.02
	260	10	223	.929	1.07
r	220	10	192	.800	.89
	220	10	175	.729	.84
r	180	10	143	.596	.66
r	195	10	158	.658	.76
year	882	10	198	.823	11.18
1906.					
	303	10	198	.825	.95
	280	10	236	.983	1.02
	270	10	235	.979	1.13
	1,061	10	610	2.54	2.83
	1,110	10	436	1.82	2.10
	1,280	16	569	2.37	2.64
	910	10	377	1.57	1.81
	780	10	285	1.19	1.37
r	290	10	240	1.00	1.12
	280	10	245	1.02	1.18
r	280	10	240	1.00	1.12
r	275	10	221	.921	1.06
year	1,280	10	324	1.35	18.33

RELATION OF RUN-OFF TO PRECIPITATION.

KENNEBEC RIVER AT WATERVILLE.

From the table of average precipitation on the Kennebec drainage basin (p. 22), and that of mean monthly run-off (pp. 57–59), the following table has been prepared, covering the run-off and precipitation for the period 1893 to 1905, inclusive. The gage heights kept of Moosehead Lake level enable a correction to be made for the amount of water stored in the lake since May, 1895, and, as explained on page 49, the run-off at Waterville has been computed as if water had not been stored, the effect of evaporation of water while in storage, however, being neglected. The ratios of run-off to rainfall thus corrected for storage are also given in this table.

Run-off and precipitation in Kennebec River basin above Waterville, Me., 1893–1905, inclusive, by months.

[Drainage area, 4,270 square miles.]

Month.	Precipitation in inches.	Run-off in inches on drainage area.		Ratio of run-off to precipitation.	
		Observed run-off.	Estimated run-off without storage.	For observed run-off.	For estimated run-off without storage.
1893.					
January	2.1	0.46		0.22	
February	3.3	.57		.17	
March	2.6	1.13		.43	
April	2.1	3.05		1.45	
May	5.3	8.23		1.55	
June	2.2	3.99		1.81	
July	2.4	1.56		.65	
August	4.0	.61		.15	
September	3.1	.53		.17	
October	6.0	.63		.10	
November	2.4	.58		.24	
December	2.9	.43		.15	
The year	38.4	21.78		.57	
1894.					
January	2.4	.44		.18	
February	1.8	.43		.24	
March	1.6	1.08		.68	
April	1.2	3.83		3.19	
May	4.6	2.58		.56	
June	4.6	2.03		.44	
July	2.3	1.54		.67	
August	2.9	.80		.28	
September	5.0	.72		.14	
October	4.8	1.01		.21	
November	2.5	.98		.39	
December	2.3	.52		.23	
The year	36.0	15.97		.44	
1895.					
January	2.8	.55		.20	
February	.9	.44		.49	
March	1.6	.54		.34	
April	4.4	6.25		1.42	
May	2.8	2.58	3.02	.92	1.08
June	2.9	1.67	.89	.58	.31
July	3.2	.95	.68	.30	.21
August	4.3	.73	.44	.17	.10
September	1.6	.46	−.05	.29	−.03
October	1.7	.34	.47	.20	.28
November	6.1	1.46	2.05	.24	.34
December	4.7	1.62	2.23	.34	.47
The year	37.0	17.58		.47	

and precipitation in Kennebec River basin above Waterville, Me., 1893-1905, inclusive, by months—Continued.

Month.	Precipitation in inches.	Run-off in inches on drainage area.		Ratio of run-off to precipitation.	
		Observed run-off.	Estimated run-off without storage.	For observed run-off.	For estimated run-off without storage.
1896.					
	0.7	1.16	1.42	1.66	2.03
	3.7	.72	.57	.19	.15
	7.0	3.54	3.73	.51	.53
	2.0	7.16	7.80	3.58	3.90
	2.7	4.60	4.24	1.70	1.57
	2.5	1.44	1.00	.58	.40
	4.4	1.44	1.01	.33	.23
	3.6	.85	.38	.24	.11
r	4.6	.89	.81	.19	.18
	3.5	.99	1.16	.28	.33
r	3.3	2.36	3.11	.72	.94
	1.1	.74	.73	.67	.66
year	39.1	25.89	25.96	.66	.66
1897.					
	3.6	.97	.95	.27	.26
	1.9	.90	.74	.48	.39
	3.2	1.07	1.03	.33	.32
	3.3	6.63	7.58	2.01	2.30
	4.9	7.26	7.53	1.48	1.54
	3.6	3.39	2.96	.94	.82
	7.2	3.54	3.39	.49	.47
	3.8	1.97	1.56	.52	.41
r	3.0	1.19	.75	.40	.25
	1.0	.71	.65	.71	.65
r	4.4	1.48	1.64	.34	.37
	3.2	1.44	1.87	.45	.59
year	43.1	30.55	30.65	.71	.71
1898.					
	4.9	.87	.85	.18	.17
	6.8	.83	.72	.12	.11
	1.0	3.04	2.71	3.04	2.71
	2.2	7.79	8.95	3.54	4.07
	1.6	6.78	6.82	4.24	4.26
	3.3	2.61	2.04	.79	.62
	1.5	1.06	.42	.71	.28
	3.7	.84	.42	.23	.11
r	3.3	.68	.60	.21	.18
	4.4	1.09	1.28	.25	.29
r	4.3	1.35	1.72	.31	.40
	1.3	.71	.86	.54	.66
year	38.3	27.65	27.39	.72	.72
1899.					
	2.4	.64	.55	.27	.23
	3.3	.58	.39	.17	.12
	4.6	.87	.82	.19	.18
	.9	6.27	7.15	6.96	7.95
	2.2	5.74	6.02	2.61	2.74
	1.8	2.30	1.72	1.28	.96
	5.4	1.37	1.25	.25	.23
	.9	.89	.54	.99	.60
r	3.0	.48	.07	.16	.02
	1.5	.34	.17	.23	.11
r	2.4	.59	.60	.24	.25
	2.5	.74	.85	.30	.34
year	30.9	20.81	20.13	.67	.65

Run-off and precipitation in Kennebec River basin above Waterville, Me., [illegible] inclusive, by months—Continued.

Month.	Precipitation in inches.	Run-off in inches on drainage area.		Ratio of run-off to precipitation.	
		Observed run-off.	Estimated run-off without storage.	For observed run-off.	[illegible]
1900.					
January	5.6	0.64	0.66	0.11	[illegible]
February	6.8	2.21	2.60	.33	[illegible]
March	5.0	2.47	2.63	.49	[illegible]
April	1.3	7.43	8.37	5.72	[illegible]
May	4.6	7.63	7.92	1.66	[illegible]
June	3.9	2.64	2.19	.68	[illegible]
July	4.0	1.55	1.38	.34	[illegible]
August	1.8	1.13	.61	.63	[illegible]
September	3.1	.74	.29	.24	[illegible]
October	3.4	.83	.75	.24	[illegible]
November	6.5	1.66	2.09	.26	[illegible]
December	1.9	1.11	1.11	.58	[illegible]
The year	48.5	30.04	30.60	.62	[illegible]
1901.					
January	2.7	.86	.71	.32	[illegible]
February	1.5	.61	.44	.40	[illegible]
March	3.9	1.30	1.04	.33	[illegible]
April	6.0	10.7	12.55	1.79	[illegible]
May	2.3	4.09	3.94	1.78	[illegible]
June	3.8	2.15	1.70	.57	[illegible]
July	3.9	1.38	.86	.35	[illegible]
August	3.9	1.13	1.17	.29	[illegible]
September	2.2	.74	.38	.33	[illegible]
October	2.8	.79	.46	.28	[illegible]
November	2.3	.63	.46	.27	[illegible]
December	7.6	3.21	2.71	.27	[illegible]
The year	42.9	27.59	26.42	.64	[illegible]
1902.					
January	2.9	1.04	1.23	.36	[illegible]
February	3.0	.92	.77	.31	[illegible]
March	8.3	7.76	8.08	.94	[illegible]
April	3.3	5.79	6.79	1.75	[illegible]
May	4.3	4.55	4.59	1.06	[illegible]
June	6.1	3.98	3.87	.65	[illegible]
July	2.7	2.11	1.54	.78	[illegible]
August	4.5	1.36	1.07	.30	[illegible]
September	3.8	1.10	1.07	.29	[illegible]
October	4.9	1.42	1.42	.29	[illegible]
November	1.2	1.18	1.46	.98	[illegible]
December	4.0	1.18	.76	.30	[illegible]
The year	49.0	32.40	32.65	.66	[illegible]
1903.					
January	3.9	1.08	1.08	.28	[illegible]
February	3.4	.97	.70	.29	[illegible]
March	5.6	5.23	6.05	.93	[illegible]
April	1.9	4.30	4.33	2.26	[illegible]
May	.5	1.96	1.91	3.92	[illegible]
June	4.8	1.75	1.41	.36	[illegible]
July	4.8	1.40	.99	.29	[illegible]
August	2.9	1.04	.80	.36	[illegible]
September	.9	.65	.21	.73	[illegible]
October	2.7	.52	.21	.19	[illegible]
November	1.4	.38	.22	.27	[illegible]
December	2.9	.37	a.37	.13	[illegible]
The year	35.7	19.66	a18.28	.55	[illegible]

a From December, 1903, to April, 1904, inclusive, no correction made for storage.

off and precipitation in Kennebec River basin above Waterville, Me., 1893–1905, inclusive, by months—Continued.

Month.	Precipitation in inches.	Run-off in inches on drainage area.		Ratio of run-off to precipitation.	
		Observed run-off.	Estimated run-off without storage.	For observed run-off.	For estimated run-off without storage.
1904.					
ry	3.0	0.26	[a] 0.26	0.09	0.09
ary	1.5	.23	[a] .23	.16	.16
	2.9	1.02	[a] 1.02	.35	.35
	5.4	3.90	[a] 3.90	.72	.72
	5.8	5.59	7.24	.97	1.25
	2.9	2.16	1.81	.74	.62
	5.1	1.44	1.15	.28	.23
it	4.9	1.27	.82	.26	.17
nber	5.8	1.12	1.18	.19	.20
er	2.4	1.27	1.63	.53	.68
nber	1.5	.88	.84	.59	.56
ıber	1.6	.74	.48	.46	.30
The year	42.8	19.89	[a] 20.56	.46	.48
1905.					
ry	3.9	.83	.16	.21	.04
ary	1.1	.64	.35	.58	.31
	1.3	1.42	1.58	1.09	1.22
	2.1	3.52	4.45	1.68	2.12
	3.1	2.83	3.53	.91	1.14
	3.9	1.75	1.50	.45	.39
	4.2	1.26	.82	.30	.20
st	2.1	.86	.37	.41	.18
mber	4.2	.78	.52	.18	.12
er	1.0	.48	.21	.48	.21
nber	3.4	.60	.48	.48	.14
ıber	2.9	.56	.40	.19	.14
The year	33.2	15.52	14.37	.47	.43

[a] From December, 1903, to April, 1904, inclusive, no correction made for storage.

he subjoined table shows the observed average monthly discharge Vaterville from 1893 to 1905 and from 1896 to 1905; the estimated :age monthly discharge at Waterville from 1896 to 1905 if no er had been stored; the average monthly precipitation from 1893 905 and from 1896 to 1905; and the ratio of the run-off to precipi- on.

he effect of storage on the distribution of seasonal run-off is rly shown by a comparison of the last two columns in the table. ing April and May water is being stored; from June to September usive this stored water is being let out; and during the remainder he year there is little effect from storage.

Summary of run-off and precipitation in Kennebec River basin above Waterville, Me., 1893–1905, inclusive.

[Drainage area, 4,270 square miles.]

Month.	Run-off in second-feet per square mile.			Run-off in inches on drainage area.			Precipitation in inches.		Ratio of run-off to precipitation.		
	Observed run-off.		Estimated run-off without storage.	Observed run-off.		Estimated run-off without storage.			For observed run-off.		For estimated run-off without storage.
	1893–1905.	1896–1905.	1896–1905.	1893–1905.	1896–1905.	1896–1905.	1893–1905.	1896–1905.	1893–1905.	1896–1905.	1896–1905.
January	0.67	0.72	0.68	0.77	0.83	0.78	3.15	3.36	0.24	0.25	.23
February	.74	.82	.72	.77	.85	.75	3.00	3.30	.26	.26	.23
March	2.03	2.40	2.49	2.34	2.77	2.87	3.74	4.28	.63	.65	.67
April	5.29	5.70	6.44	5.90	6.36	7.18	2.78	2.84	2.12	2.24	2.58
May	4.30	4.43	4.67	4.96	5.11	5.38	3.44	3.20	1.44	1.60	1.68
June	2.19	2.17	1.82	2.44	2.42	2.03	3.56	3.66	.69	.66	.57
July	1.63	1.44	1.11	1.88	1.66	1.28	3.98	4.38	.47	.38	.29
August	.90	.98	.67	1.04	1.13	.77	3.33	3.21	.31	.35	.24
September	.70	.75	.53	.78	.84	.59	3.35	3.39	.23	.25	.17
October	.69	.73	.69	.80	.84	.80	3.09	2.76	.26	.30	.29
November	.98	1.00	1.13	1.09	1.12	1.26	3.21	3.07	.34	.36	.41
December	.81	.93	1.01	.93	1.07	1.16	3.00	2.90	.31	.37	.40
Total				23.70	25.00	24.85	39.63	40.35			
Monthly average	1.74	1.84	1.83	1.98	2.08	2.07	3.30	3.36	.60	.62	.61

RUN-OFF AND PRECIPITATION ON COBBOSSEECONTEE STREAM AT GARDINER.

The following table has been prepared for precipitation and run-off on Cobbosseecontee Stream at Gardiner, covering the period 1891 to 1905, inclusive, precipitation being taken from the records at Gardiner, except for a few Lewiston records during 1891–92. It must be kept in mind that the run-off from this drainage basin is controlled to a very large extent by lake storage, and for that reason the monthly ratios are not in general the actual run-off ratios. The mean results for the year are, however, probably not greatly affected in this way, although the general effect of storage is to reduce the amount of these ratios.

-off and precipitation in basin of Cobbosseecontee Stream above Gardiner, Me., 1891–1905, inclusive.

[Drainage area, 240 square miles.]

Month.	Precipitation in inches.	Run-off in inches on drainage area.	Ratio of run-off to precipitation.	Month.	Precipitation in inches.	Run-off in inches on drainage area.	Ratio of run-off to precipitation.
1891.				1895.			
ıry	8.10	2.32	0.29	January	2.50	1.05	0.42
ıary	3.89	2.42	.62	February	1.64	.794	.48
ı	7.03	6.65	.95	March	2.48	.783	.32
	2.89	5.94	2.06	April	4.83	.359	.74
	2.60	1.21	.47	May	1.50	1.15	.79
	3.64	1.20	.33	June	2.01	1.08	.54
	5.27	1.18	.22	July	4.55	1.13	.25
st	2.97	1.15	.39	August	3.28	1.14	.35
mber	1.00	1.10	1.10	September	1.21	.929	77
ber	2.40	.932	.39	October	1.82	.485	.27
mber	2.66	.374	.14	November	6.85	.669	.10
nber	5.27	.706	.13	December	4.40	.898	.20
The year	47.72	25.18	.53	The year	37.07	10.47	.28
1892.				1896.			
ıry	5.52	1.04	.19	January	.87	1.11	1.28
ıary	2.21	1.08	.49	February	5.25	1.06	.20
ı	2.43	1.18	.49	March	7.19	5.29	.74
	1.05	1.14	1.09	April	2.02	3.77	1.87
	4.62	1.21	.26	May	2.80	1.10	.39
	7.22	1.08	.15	June	1.94	1.13	.58
	3.18	.869	.27	July	3.18	1.13	.35
st	8.11	1.18	.15	August	2.88	1.09	.38
mber	4.48	1.13	.25	September	7.60	1.02	.13
ber	1.81	1.13	.63	October	2.64	.971	.37
mber	4.54	1.08	.24	November	4.12	.865	.21
nber	1.49	1.18	.79	December	1.52	1.01	.67
The year	46.66	13.30	.28	The year	42.01	10.55	.46
1893.				1897.			
ıry	2.70	1.13	.42	January	4.51	1.01	.22
ıary	4.79	1.08	.23	February	2.13	.977	.46
ı	3.18	1.90	.60	March	4.30	1.06	.25
	2.52	2.82	1.12	April	2.86	2.03	.71
	4.66	4.92	1.05	May	5.94	1.97	.33
	2.56	1.16	.45	June	4.32	1.78	.41
	1.12	1.09	.98	July	3.15	1.14	.36
st	3.27	1.14	.35	August	2.66	1.13	.43
mber	3.23	.916	.28	September	3.11	1.13	.36
ber	5.90	.860	.15	October	.92	.966	1.05
mber	1.83	.869	.47	November	5.99	1.09	.18
nber	5.13	.851	.17	December	3.83	1.11	.29
The year	40.89	18.74	.46	The year	43.72	15.39	.35
1894.				1898.			
ıry	3.30	.922	.28	January	5.54	1.13	.20
ıary	1.99	.821	.41	February	5.45	1.30	.24
ı	1.44	1.64	1.14	March	1.76	4.05	2.30
	1.86	1.27	.68	April	3.44	2.75	.80
	5.84	1.46	.25	May	1.60	1.46	.91
	1.18	1.52	1.29	June	3.56	1.13	.32
	2.30	1.09	.47	July	.98	1.09	1.10
st	3.08	1.18	.38	August	3.73	1.15	.31
mber	3.81	1.01	.27	September	2.90	1.02	.34
ber	4.25	1.05	.25	October	6.23	.960	.10
mber	2.21	.967	.44	November	4.57	.697	.21
nber	2.80	.971	.35	December	2.74	1.12	.41
The year	34.06	13.90	.41	The year	42.50	18.13	.43

Run-off and precipitation in basin of Cobbosseecontee Stream above Gardi
1905, inclusive—Continued.

Month.	Precipitation in inches.	Run-off in inches on drainage area.	Ratio of run-off to precipitation.
1899.			
January	3.41	1.09	0.32
February	3.10	1.00	.32
March	5.56	1.13	.20
April	1.19	3.60	3.02
May	1.87	1.18	.63
June	2.43	1.13	.47
July	5.48	1.09	.20
August	1.08	1.15	1.06
September	3.90	.772	.20
October	1.85	.414	.22
November	2.42	.609	.25
December	2.61	.557	.21
The year	34.90	13.72	.39
1900.			
January	7.19	.572	.08
February	8.96	1.97	.21
March	7.23	6.56	.91
April	2.50	4.48	1.79
May	5.42	2.62	.48
June	1.34	1.14	.85
July	1.87	1.07	.57
August	2.77	1.10	.40
September	2.45	.948	.39
October	4.47	.865	.19
November	5.28	.800	.15
December	1.64	.898	.55
The year	51.12	23.02	.45
1901.			
January	3.78	.966	.26
February	1.76	.647	.37
March	6.25	1.44	.23
April	6.43	8.07	1.25
May	3.97	1.22	.31
June	1.36	1.28	.94
July	4.26	1.13	.27
August	5.54	1.18	.21
September	2.08	1.06	.51
October	4.18	1.05	.25
November	2.41	.953	.39
December	9.43	2.12	.22
The year	51.45	21.12	.41
1902.			
January	2.67	2.17	.81
February	1.70	1.25	.74
March	10.33	6.55	.63
April	3.71	3.21	.87
May	2.01	1.61	.80
June	4.52	1.08	.24
July	2.07	1.09	.53
August	4.46	1.13	.25
September	3.22	1.13	.35
October	4.90	1.15	.23
November	1.21	1.05	.87
December	5.35	1.10	.21
The year	46.15	22.52	.49

Month.	Precipitation in inches.	R in on ag
1903.		
January	4.54	
February	3.63	
March	6.65	
April	1.42	
May	.45	
June	5.12	
July	4.77	
August	2.90	
September	1.34	
October	3.82	
November	1.63	
December	3.56	
The year	39.83	1
1904.		
January	4.12	
February	2.24	
March	3.71	1
April	7.10	2
May	3.95	3
June	1.29	1
July	1.25	1
August	4.53	1
September	5.09	1
October	2.02	1
November	2.39	
December	2.28	
The year	39.97	15
1905.		
January	4.85	
February	1.32	
March	.94	
April	2.10	1
May	2.17	1
June	4.83	1
July	4.52	1
August	2.03	1
September	4.09	
October	.78	
November	3.95	
December	3.12	
The year	34.70	11

The following table shows for the whole period the run-off and precipitation, and the ratio of these two factors, by calendar months, just as was done for Waterville. It will be noted that the mean yearly ratio of run-off to precipitation at Gardiner is 0.41, whereas at Waterville for the period 1896 to 1905 it is 0.62, both for observed run-off and for that corrected for storage. The average yearly discharge at Gardiner is 1.28 second-feet per square mile of drainage area; at Waterville (1896–1905) it is 1.84 second-feet. For the longer period, 1893 to 1905, at Waterville the ratio of run-off to precipitation and the average yearly discharge are slightly less, being respectively 0.60 and 1.74 second-feet.

Summary of run-off and precipitation in basin of Cobbosseecontee Stream above Gardiner, Me., 1891–1905, inclusive.

[Drainage area, 240 square miles.]

Month.	Average run-off in second-feet per square mile of drainage area.	Run-off in inches on drainage area.	Precipitation in inches.	Ratio of run-off to precipitation.
January	0.98	1.13	4.24	0.27
February	1.07	1.11	3.34	.33
March	2.77	3.19	4.70	.68
April	2.72	3.03	3.06	.99
May	1.57	1.81	3.29	.55
June	1.08	1.20	3.15	.38
July	.94	1.08	3.20	.34
August	.98	1.13	3.55	.32
September	.90	1.00	3.30	.30
October	.79	.91	3.20	.28
November	.74	.83	3.47	.24
December	.84	.97	3.68	.26
Total	.....	17.39	42.18	.....
Monthly average	1.28	1.45	3.52	.41

EVAPORATION.

No measurements of evaporation from the water surface have been made in the Kennebec drainage basin, but from data obtained by the United States Geological Survey at several points in Maine during the past year, an approximate idea may be obtained as to its amount.

Stations for the measurement of evaporation from the water surface are in operation as follows:

Evaporation stations in Maine.

Station.	Location.	Date established.
Soldier Pond	Soldier Pond	July 1, 1905.
Millinocket	Ferguson Pond	Do.
Lewiston	Androscoggin River	Do.
Upper Dam	Mooselookmaguntic Lake	August 19, 1905.

The method used for the measurement of evaporation has been that of the floating raft and dish, commonly used for this purpose. Pl. II, *B* (p. 26), shows the evaporation raft, etc., on Androscoggin River at Lewiston, Me., in the mill pond of the Union Water Power Company. A skeleton log raft about 15 feet square is arranged to float with its surface just out of the water. A clear opening 6 feet square is left in the center and in this opening the evaporation pan floats, its top being kept perhaps 2 or 3 inches above the water surface by means of galvanized-iron pontoons, which are cylindrical in shape and air-tight. The evaporation pan is 3 feet square and 18 inches deep, and is constructed of galvanized iron, properly braced with iron straps. A spindle with sharp point is fixed vertically in the middle of the pan, with its point 1 or 2 inches below the top.

In measuring the amount of evaporation the water surface is made of exactly the same height as the point of the spindle, and then at the next time of observation the process is repeated, the amount of water required to restore the water surface to the level of the spindle point being noted. The spindle is surrounded by a thin iron cylinder about 3 inches in diameter, with its axis parallel to the spindle and closed with the exception of some small holes near the bottom. This prevents rapid movement of the water surface and enables very close determinations to be made of its height. A small cup of such capacity that it represents 0.01 inch depth of water in the pan is used for pouring in the water (or dipping it out in case it has rained and the rainfall has exceeded the evaporation), so that the number of cupfuls represents the change in depth in hundredths of inches—the evaporation if there has been no rainfall. A rain gage is maintained on the raft so that correction can be made for any rainfall.

The temperature of the air and of the water in the pan and outside of the pan are noted, and at the Millinocket and Lewiston stations relative humidity and velocity of wind are also observed.

The results obtained have been in general very satisfactory, and it has been found that with the spindle point surrounded by a cylinder, as just described, the water surface moves but little, even when the pan is being considerably shaken about by wave motion. A difference of half a cupful (0.005 inch) can readily be detected.

The figures given in the subjoined table for evaporation during the frozen season are from the Lewiston station. They were obtained by filling an iron dish, allowing it to freeze solidly, and then exposing it. The weight was observed from time to time and the loss by evaporation thus determined. Continuous observations could not be made owing to interruptions by rain and sleet. In all probability the amounts observed in this way are considerably larger than the actual amount of evaporation on lakes and reservoirs, as usually some snow is *on hand to protect* the lake ice cover.

About one year's records of evaporation are now available, and the monthly amounts as observed are given below. For the purpose of comparison the evaporation from the water surface in the vicinity of Boston, as determined by FitzGerald,[a] are also given.

Evaporation from water surface, in inches, in Maine and Massachusetts.

Period.	Soldier Pond, Me.	Milli-nocket, Me.	Lewis-ton, Me.	Average evapora-tion at three stations in Maine for full months.	Average evapora-tion near Boston, Mass.
1905.					
July	4.30	5.56	5.99	5.28	6.21
August	5.25	5.80	4.32	5.12	5.97
September	2.65	3.32	3.02	3.00	4.80
October	1.51	2.94	2.54	2.33	3.47
November 1-15	.16	.48	.38	.68	2.24
December (24 days)	.....	.....	.60	.77	1.38
1906.					
January (22 days)	.....	.....	.90	1.27	.98
February (24 days)	.....	.....	.71	.83	1.01
March (26 days)	.....	.....	1.87	2.23	1.45
April (25 days)	.....	.....	2.90	3.48	2.39
May	1.67	.....	2.14	1.90	3.82
June	2.88	.....	2.86	2.87	5.34
The period	.....	.....	.....	29.76	39.12

It is evident from the foregoing table that evaporation from the water surface is, as would be expected, considerably less in Maine than near Boston. Of course but one year's records are at hand for Maine, and more data may show a considerable change from the present results, but as evaporation is a factor which does not vary greatly for a given month from year to year it is believed that these figures—especially those for the summer months—afford a fair idea of what may be expected. Probably the average annual evaporation from the water surface in Maine is about 30 inches, as compared with 39.12 inches at Boston. For the period from May to September, inclusive, evaporation in Maine is 18.17 inches, as compared with 26.14 inches near Boston.

FLOODS ON KENNEBEC RIVER.

Valuable records regarding floods on Kennebec River during the past century have been gathered by the Hollingsworth & Whitney Company, and through its courtesy have been furnished for use in the preparation of this report.

FLOOD OF 1832.

The greatest freshet of early times, and the one with which all later ones have been compared, was that of May 22, 1832. At that time there was probably no dam at Moosehead Lake outlet, and the freshet

[a] FitzGerald, Desmond. Evaporation: Trans. Am. Soc. Civil Eng., vol. 15, 1886, p. 581.

is said to have resulted from a northeasterly storm of weeks' duration, with a strong wind, which probably increase the discharge from the lake.

FLOOD OF DECEMBER, 1901.

In December, 1901, occurred a freshet which was c greater magnitude than that of 1832 and regarding which plete data are at hand.

WEATHER CONDITIONS.

During November, 1901, the precipitation in the Ken was considerably below the average, the deficiency for being nearly 0.9 inch. (See table, p. 22.) December wa remarkable in the amount of precipitation, the excess abo mal for the month being about 4.5 inches, and a little over occurring before December 16. Probably most of the p during November remained as snow storage at the end of Good-sized storms occurred about December 3 and 10, th tion from which was practically all held as snow storag December 13 to 15 there was a warm rain, which melted part of the snow on the ground and caused the flood condi following tables give the precipitation and temperature i nebec basin during the period mentioned:

Precipitation, in inches, in Kennebec basin, November and Decembe

	Fairfield.	Mayfield.	The I
Water equivalent of snow on ground December 1	2.19	2.20	
December 1-13, inclusive	2.99	2.15	
December 14-15 storm	2.63	3.00	
	7.81	7.35	

Maximum and minimum daily temperatures in Kennebec basin, December

Day.	Fairfield.		Kineo.		Day.	Fairfield.	
	Maximum.	Minimum.	Maximum.	Minimum.		Maximum.	Minimum.
	°F.	°F.	°F.	°F.		°F.	°F.
1	30	7	39	26	11	40	26
2	43	14	41	10	12	35	9
3	42	20	20	15	13	34	16
4	24	15	18	12	14	53	33
5	26	−7	15	9	15	54	44
6	24	−15	15	0	16	51	6
7	32	−13	14	−3	17	23	6
8	28	4	12	10	18	23	7
9	38	25	31	15	19	19	5
10	46	26	35	28	20	21	8

The rain of December 13 began in the evening, but most of the rainfall occurred during the day of December 15 (Sunday), the weather clearing on the evening of that day. During most of these three days, and extending to the evening of the 16th, the temperature was abnormally high (see table, p. 116), so that the combined effect of rain and high temperature was sufficient to release the greater part of the precipitation that had been stored on the ground since about November 1. It is probably safe to assume that an average of 6 inches depth of water on the entire Kennebec drainage basin was released at this time.

RUN-OFF DURING FLOOD OF DECEMBER, 1901.

The following table gives the conditions of gage height and run-off at Waterville during December 15–23:

Discharge of Kennebec River at Waterville, Me., during flood of December, 1901.

Date.	Hour.	Gage height. (Referred to Hollingsworth & Whitney datum.)	Depth of flow over dam.	Discharge.
		Feet.	*Feet.*	*Sec.-feet.*
December 15	7 a. m.	125.00	1.30	3,540
Do	12 m.	126.10	2.40	8,910
Do	6 p. m.	129.10	5.40	30,500
December 16	12 a. m.	132.80	13.30	121,300
Do	1 a. m.	133.64	14.14	133,500
Do	2 a. m.	133.94	14.44	138,100
Do	3 a. m.	134.33	14.83	144,100
Do	4 a. m.	134.45	14.95	145,900
Do	5 a. m.	134.70	15.20	149,800
Do	6 a. m.	135.05	15.55	155,200
Do	7 a. m.	135.15	15.65	156,800
Do	8 a. m.	135.15	15.65	156,800
Do	9 a. m.	135.15	15.65	156,800
Do	10 a. m.	135.05	15.55	155,200
Do	11 a. m.	135.00	15.50	154,500
Do	12 m.	134.80	15.30	151,300
Do	1 p. m.	134.00	14.50	139,000
Do	2 p. m.	133.50	14.00	131,600
Do	3 p. m.	133.30	13.80	128,600
Do	4 p. m.	132.60	13.10	118,400
Do	5 p. m.	132.20	12.70	112,700
Do	6 p. m.	131.80	12.30	107,200
December 17	12 a. m.	129.10	9.60	72,400
Do	7 a. m.	127.40	7.90	53,400
Do	12 m.	126.70	7.20	46,200
Do	5 p. m.	126.10	6.60	40,400
December 18	12 m.	124.40	4.90	25,600
December 19	12 m.	.....	.....	19,900
December 20	12 m.	.....	.....	11,800
December 21	12 m.	.....	.....	6,380
December 22	12 m.	.....	.....	5,230
December 23	12 m.	.....	.....	3,980

It is assumed in the above table that the flashboards were off entirely between 6 p. m. and midnight of December 15. Up to this latter time the depth of flow on the dam is obtained by subtracting 124.7 feet (elevation of top of flashboards) from the gage height. After and including midnight of December 15 the elevation of the crest of the dam (119.5 feet) is used.

The mean daily flow, December 15–18, was as follows (that for December 16 is based on hourly observations):

Mean flow of Kennebec River at Waterville, Me., December 15–18, 1901.[a]

	Second-feet.
December 15	27,300
December 16	127,000
December 17	46,600
December 18	29,300

The maximum discharge at Madison was computed by H. S. Ferguson and found to be 105,000 second-feet. The length of the dam is 550 feet. At 8 a. m. December 15 the water was just flowing over the crest; at midnight that day it reached the maximum height of 14.5 feet, and by 10 a. m. December 16 it had dropped to about 9 feet on the crest.

At The Forks the maximum gage height reached was 9.0 feet December 15, corresponding to a discharge of about 22,400 second-feet.

MAXIMUM DISCHARGE DURING FLOOD OF DECEMBER, 1901.

Only a few gates were open at the Moosehead Lake outlet during this flood, and practically all of the excess inflow was held in the lake, so that about 1,240 square miles of drainage area should be disregarded, in part, at least, in computing the probable yield per square mile below Moosehead. The rise in the level of the lake occasioned by this freshet (see table, p. 72) was from gage height 1.25 feet December 13 to the maximum of 4.5 feet February 3, 1902, a total amount of 3.25 feet.

The following table gives the maximum flow at several points and the corresponding unit flow per square mile, with and without the drainage area above the Moosehead Lake outlet:

Maximum discharge of Kennebec River during the freshet of December, 1901.

	Waterville.	Madison.	The Forks.
Maximum discharge, in second-feet	156,800	105,000	22,400
Maximum run-off, in second-feet per square mile:			
Including drainage area above Moosehead outlet	36.7	32.8	14.3
Not including drainage area above Moosehead outlet	51.6	53.6	68.0

A portion at least of the drainage area at the Moosehead outlet should be considered in the foregoing computations, so that the probable maximum yield at Waterville and Madison was perhaps 45 second-feet per square mile of drainage area tributary during the flood.

[a] These figures vary slightly from those given on p. 54, which are based on a single reading of the gage.

COMPARATIVE HEIGHTS OF FLOODS.

Several landmarks along Kennebec River in the vicinity of Waterville and Winslow have existed for such a length of time as to furnish data on comparative heights of water in freshets since and including that of 1832. Perhaps the most interesting and valuable of these is the "freshet oak," as it is called, situated in Winslow, on the east side of Ticonic Bay, about 1,000 feet below the highway bridge, near the Lockwood Company's dam. Pl. III, *B*, shows the "freshet oak" at about the time of highest water, December 16, and Pl. III, *A* (looking in the opposite direction), shows it a few days later, when the river was at about normal height. Marks made by logs at various times of high water for many years are plainly discernible in the second view, also the height reached in this December flood, as shown by ice adhering to the tree. These photographs were taken by James L. Dean, engineer of the Hollingsworth & Whitney Company, and furnished through his courtesy.

Dates of important freshets on Kennebec River and heights on the "freshet oak" are given in the following table:

Approximate height of water at "freshet oak" during floods.

	Feet.[a]
May 22, 1832	104.8
October, 1854	102.8
October, 1869	102.7
April 30, 1887	102.2
December 16, 1901	105.14

As the flow of Kennebec River in the vicinity of the "freshet oak" is comparatively free, the nearest dam downstream, that at Augusta, being about 17 miles distant, these gage heights probably give a very good index of the relative magnitude of these freshets.

The flood of December, 1901, is, so far as known, by far the greatest flood of the past century. As it came at a time of the year when the ice was not very thick and when few logs were in the river, there was little obstruction to flow. The height of water in the 1832 freshet, and, in fact, that in many other periods of abnormally high water since, was due to log jams and collected débris holding back the water, probably at Fairfield, until the whole mass gave way, producing the flood wave.

The water held back at Moosehead Lake in December, 1901, would have probably increased the maximum flow at Waterville by one-sixth, and unquestionably a large amount of additional damage would have resulted to property along the river if the discharge from this portion of the drainage basin had not been mostly shut off.

[a] Hollingsworth & Whitney datum.

LOW-WATER CONDITIONS.

KENNEBEC RIVER.

The most severe and long-continued drought in the period by this report, viz, from 1895 to 1906, occurred during the l of 1903 and the early part of 1904. During this time the Mo Lake level was below the bottom or zero of the gage at the and no data on change in lake level between December, 19 April, 1904, are at hand. It is probable, however, that t during most of this time was little affected by lake storage, the run-off was approximately normal. The following tab the run-off during this low-water period at Waterville, North and The Forks for various lengths of time:

Run-off of Kennebec River during low-water conditions of 1903–4.

	Waterville (drainage area, 4,970 square miles).			North Anson (drainage area, 2,790 square miles).			The Forks area, 1,[illegible] miles).
[illegible]	Period.	Mean discharge in second-feet.	Run-off in second-feet per square mile.	Period.	Mean discharge in second-feet.	Run-off in second-feet per square mile.	Period.
[illegible]	December 11-16, [illegible]	727	0.17	January 25–30, 1904.	a 617	0.22	November, December 1903
[illegible]	[illegible] to [illegible], 1904.	921	.22	February, 1904....	680	.24	November.
[illegible]	[illegible], 1903, to [illegible], 1904.	1,095	.26	January to March, 1904.	763	.27	October to cember, 1
[illegible]	[illegible], 1903, to [illegible], 1904.	1,520	.36	October 13, 1903, to March, 1904.	1,119	.40	.....
[illegible]	[illegible] to [illegible], 1904.	4,373	1.02	April, 1903, to March, 1904.	3,506	1.26	.....

[a] Average of three days during this week.
Fifteen days in December.

The following table shows very clearly the effect of sto increasing flow during the period from September to No inclusive, which would probably have been the time of lowes under natural conditions of flow:

[illegible] second-feet per square mile, of Kennebec River at Waterv [illegible] with and without storage.

[illegible]	Period.	Estimated flow without storage.
[illegible]	September, 1903.....	0.16
[illegible]	September to November, 1903.....	.19
[illegible]	September, 1903, to February, 1904...	.22

A

B

"FRESHET OAK," KENNEBEC RIVER AT WINSLOW, ME.

A, During flood of December, 1901; *B*, After flood of December, 1901.

LOW-WATER CONDITIONS ON TRIBUTARIES OF KENNEBEC RIVER.

The following table gives the lowest observed flow for various lengths of time during the period since gaging stations were established on the Moose, Roach, Dead, Carrabassett, Sandy, Messalonskee, and Cobbosseecontee. It must be kept in mind that winter records are not in general available for these stations, and consequently the figures given may not represent the true minima for the given lengths of time during this period, which for the first four stations began in 1902 and for the other three as noted in the table. In the latter part of 1903 very low water conditions existed.

Low-water discharge, in second-feet per square mile, of tributaries of Kennebec River.

Lowest or lowest successive—	Moose River at Rockwood (drainage area 680 square miles).		Roach River at Roach River (drainage area 85 square miles.)		Dead River at The Forks (drainage area 870 square miles).		Carrabassett River at North Anson (drainage area 340 square miles).	
	Period.	Discharge.	Period.	Discharge.	Period.	Discharge.	Period.	Discharge.
Six week days..	March 26-31, 1906.	0.13	November 13-18, 1905.	0.01	October 12-17, 1903.	0.15	September 23-28, 1903.	0.19
One month....	October, 1903	.15	October, 1905	.32	October, 1903.	.20	September, 1903.	.32
Three months.	October to December, 1903.	[a].17	October to December, 1903.	.32	September to November, 1903.	.29	September to November, 1903.	.46

Lowest or lowest successive—	Sandy River at Madison [b] (drainage area 650 square miles).		Messalonskee Stream at Waterville [c] (drainage area 205 square miles).		Cobbosseecontee Stream at Gardiner [d] (drainage area 240 square miles).	
	Period.	Discharge.	Period.	Discharge.	Period.	Discharge.
Six week days..	October 2-7, 1905..	0.08	December 14-19,1903	0.23	October 23-28, 1899.	0.27
One month....	October, 1905.....	.14	November, 1903.....	.29	November, 1891....	.34
Three months.	October to December, 1905.	.32	October to December, 1903.	.35	October to December, 1899.	.46

[a] Sixteen days in December.
[b] Sandy River station established in 1904.
[c] Messalonskee Stream station established in 1903.
[d] Cobbosseecontee Stream station established in 1890.

WATER POWER.

DEVELOPED WATER POWERS.

The following brief descriptions of developed water powers in the Kennebec basin are based for the most part on data furnished by letters from the mill owners and users of power. This is supplemented where possible by the information obtained from time to time by the hydrographers of the United States Geological Survey, in connection with their regular trips to gaging stations. Every effort has been made to avoid errors, but it must be realized that these

descriptions have to be based largely on reports made up by persons who are not in general experienced in reporting such data, and some inaccuracies are bound to exist.

KENNEBEC RIVER.

The uppermost of the developed water powers on the Kennebec is that of the International Paper Company at Carritunk Falls, near Solon. There is a natural fall at this point of about 28 feet through a narrow gorge, above which the river widens out. The dam was built in 1891 and affords an average head of about 29 feet. Turbines aggregating about 3,000 horsepower are installed, and the power is used in the manufacture of ground wood pulp. This dam ponds the water for about 2 miles upstream.

The next utilized power downstream is that at Madison, which is used by the Great Northern Paper Company for manufacturing paper, ground wood pulp, and sulphite fiber; by the Indian Spring Woolen Company and the Madison Woolen Company for manufacturing woolen goods, and by the Madison pumping station for pumping the town water supply. The two woolen companies use about 400 horsepower each, the pumping station a small amount, and the balance is taken by the paper company, which uses about 1,200 electrical horsepower at all times, and has in addition grinder units that require a maximum of about 200 horsepower. The electric plant is run throughout the year at full capacity and the grinders perhaps average half power throughout the year. The dam at Madison ponds water nearly up to the mouth of Carrabassett River, a distance of about 5½ miles.

The next dam is at Skowhegan, where the power is controlled by the Skowhegan Water Power Company. A head of 18 to 20 feet is obtained, and 28 wheels aggregating a capacity of 5,100 horsepower are in use. Of this amount, 2,900 horsepower is employed in the manufacture of pulp, 750 horsepower for electric lights and power, and the remainder by grist, saw, planing, and woolen mills and a sash and blind factory. Some of the wheels operate factories by day and electric lights by night. The dam ponds water to about 1 mile above Norridgewock, a total distance of about 6 miles.

At the village of Shawmut, in the town of Fairfield, is a dam affording a fall of about 12 feet, owned by the Shawmut Manufacturing Company. The power is utilized by pulp mills, an electric-light plant, a furniture factory, and a woolen mill. This dam ponds water 7 or 8 miles upstream, or considerably more than halfway to Skowhegan.

At Fairfield is a log dam about 1,300 feet long, with a total fall of 11 feet. This dam is owned by the Fairfield Junction Mills and

ater Power Company, and furnishes power for two sawmills and a aning mill. There are eight or ten wheels, developing about 1,000 orsepower. This dam ponds water to the foot of the Shawmut dam, distance of about 3 miles.

At Winslow are the dam and mills of the Hollingsworth & Whitey Company (privilege formerly known as the College Rapids). This ompany manufactures manila paper and ground wood and sulphite ulp. A fall is obtained of about 23 feet. There are 46 turbines with n aggregate capacity of about 8,500 horsepower, in addition to 2,000 horsepower of auxiliary steam. This dam ponds water to the foot of the Fairfield dam, a distance of about 2½ miles.

At Ticonic Falls, between Waterville and Winslow, are the cotton mills of the Lockwood Company, about 2,400 horsepower being used. A dam 750 feet long raises the river surface 7 feet, and a further natural fall of about 13 feet on a slate ledge gives a total fall of 20 feet. This dam ponds water to the foot of the Hollingsworth & Whitney dam, a distance of about 1 mile upstream.

At Augusta, at the head of tide water, is a timber-crib dam affording ordinarily a head of 17 feet. On the west bank the Edwards Manufacturing Company uses about 2,500 horsepower for its cotton mills; on the east bank 1,500 horsepower is used by the Cushnoc Paper Company and the Kennebec Light and Heat Company, the latter furnishing the municipal lights of Augusta, Hallowell, Gardiner, and Togus. The fall at this dam is affected somewhat by the rise of tide. At ordinary stages the water is ponded by the dam for about 12 miles upstream, or about three-fourths of the way to Winslow and Waterville.

DEAD RIVER.

There are no water powers of importance on Dead River; on North Branch at Eustis is a dam affording a head of 8 feet, used for a lumber and grist mill; on South Branch at Stratton is also a small developed power.

CARRABASSETT RIVER.

At Kingfield is a dam affording a head of 10 to 12 feet, used for lumber and planing mills and the manufacture of rakes, cant dogs, cotton-mill rolls, etc. Wheels aggregating about 170 horsepower are installed, about half of which can be run during the low-water season.

At East New Portland the Carrabassett Stock Farm Company owns a privilege affording a head of 15 to 26 feet, used for a sawmill and electric-light plant, with three wheels rated at a total of 465 horsepower. Auxiliary steam (75-horsepower boiler) is also used.

At North Anson just above the Somerset Railway bridge a dam

affording a head of about 9 feet is used by the North Anson Lumber Company for a sawmill. One wheel is installed, rated at 110 horsepower, 70 per cent of which is available at low water. A short distance downstream, near the entrance of Mill Stream, a dam is being constructed (1906) to utilize the flow of both Carrabassett River and Mill Stream. A paper and pulp mill of the American Pulp, Paper and Lumber Company will be placed on the right bank and utilize practically all of the undeveloped fall at North Anson, amounting to about 40 feet.

On the tributaries of Carrabassett River are a few small developments, principally at North and West New Portland.

SANDY RIVER.

At Phillips is a dam affording a head of 20 feet, used for a sawmill and electric-light plant; two wheels are installed, rated at 125 horsepower; the low-water flow, lasting usually about a month, is good for 40 or 50 horsepower.

At Fairbanks is a developed privilege.

At Farmington is a dam affording a fall of about 7 feet, used for a lumber mill.

At Farmington Falls a dam gives a head of 8 or 9 feet, used in manufacturing carriages, sleighs, etc.

At New Sharon a fall of 10 feet is utilized for the manufacture of shoes and shoe boxes.

Near Madison, a few miles from the mouth of the river, is a masonry dam, affording a fall of 15 feet, used for electric light and power. (See p. 87 for additional details of this plant.)

SEBASTICOOK RIVER.

At Hartland, on West Branch, are two dams, the upper affording a head of about 6 feet and operating two wheels for a lumber and planing mill, which uses half the flow. The remaining water is carried farther downstream, and discharged under a head of 16 feet, with a second dam providing a fall of about 11 feet, used by the Linn Woolen Company for the manufacture of shawls, rugs, dress goods, etc. This company has about 180 horsepower of wheels and 150 horsepower of auxiliary steam.

At Pittsfield, on West Branch, is a dam affording a head of about 11 feet, utilized by the Waverley Woolen Company, which has three wheels aggregating 300 horsepower and 250 horsepower of auxiliary steam (used only in times of very low water). About half a mile farther downstream is a privilege affording a fall of about 10 feet; one-third of the flow at this point is utilized by the Smith Woolen Company (one *wheel of 60 horsepower* and auxiliary steam of 85 horsepower), and

the remainder by Robert Dobson & Co., manufacturers of woolen goods, who have 150 horsepower of wheels and 215 horsepower transmitted electrically from the Sebasticook Power Company's plant near Burnham.

At Corinna, on East Branch, is a dam affording a head of 10 feet, used for a flour and grist mill, with wheels of about 90 horsepower installed.

At Newport, on East Branch, is the plant of the Newport Woolen Company, which utilizes a fall of about 10 feet, with 135 horsepower of wheels and 75 horsepower of auxiliary steam.

At Detroit, on East Branch, is a dam with head of about 12 feet, used for a lumber mill, with turbines of 250 horsepower.

Near Burnham Junction, on the main river, is a timber-crib dam with masonry abutments, built in 1903, giving a head of about 27.5 feet. This is owned by the Sebasticook Power Company and used for generating light and power to be transmitted, mostly to Pittsfield at present. The plant is not yet fully developed; three pairs of wheels are installed, rated in the aggregate at about 800 horsepower, and the company has 400 horsepower of auxiliary steam. The minimum flow at this point is considered to be good for 1,200 horsepower.

At Clinton is a dam affording a head of about 6 or 8 feet, used for flour and grist and lumber mills. Wheels of about 200 horsepower are installed.

At Benton Falls a fall of 25 feet is utilized by the United Box Board and Paper Company, which has wheels of about 800 horsepower installed and manufactures wood-pulp board.

MESSALONSKEE STREAM.

There are several dams affording slight falls between the various lakes in the headwaters of Messalonskee River—at Smithfield, between East and North ponds (7-foot fall); at Belgrade Mills, between Great and Long ponds (9-foot fall), etc.

At Oakland the following powers have been developed: (1) A dam at the foot of Messalonskee Lake, with 8-foot fall, utilized for woolen mill, pumping station, and ax factory; (2) a dam with 12-foot fall, used for scythe and ax factory, machine shop, and shoddy mill; (3) a dam with 14-foot fall, two 48-inch Hercules wheels, used for ax, scythe, and tool factory; (4) a dam with 40-foot fall, 600 horsepower of wheels used by Messalonskee Electric Company and about 100 horsepower for scythe forge shop; (5) a dam with 18-foot fall, 150-horsepower wheel used by Cascade Woolen Mill, the balance unused. The last three privileges are owned by the Dunn Edge Tool Company.

A dam with a fall of about 14 feet is used for pumping the Waterville municipal water supply, which comes by gravity flow from China Lake. Just below is the dam of the Chase Manufacturing Company,

with a fall of about 8 feet. (See p. 90 for further description of th[illegible] plant.) About a mile farther downstream, a short distance fro[illegible] the mouth of the river, is a masonry dam affording a fall of about 4[illegible] feet, owned by the Waterville Gas and Electric Company and use[illegible] for electric light and power.

COBBOSSEECONTEE STREAM.

There are developed privileges at Readfield, Winthrop, and Mo[illegible] mouth.

Between Cobbosseecontee Pond and Gardiner are two develope[illegible] privileges, which, however, are not of much value for power becau[illegible] at times all the water is shut back for storage purposes in the pond[illegible]

At Gardiner there are seven dams controlled by the Gardiner Wat[illegible] Power Company. They afford a total fall of 128 feet, used as in[illegible] cated in the following table:

Developed water powers at Gardiner, Me.

Owner.	Use.	Fall.	Hor[illegible] pow[illegible]
		Feet.	
Gardiner waterworks	Pumping station	9	([illegible]
S. D. Warren & Co	Paper mill	37	[illegible] b 1.
Hollingsworth & Whitney Co	do	17	[illegible]
Do	do	16	[illegible]
Do	do	16½	[illegible]
Joshua Gray & Son	Lumber mill	12½	[illegible]
Gardiner estate	Various small industries	15-20	[illegible]

[illegible] See p. 93 for further description of this plant. b 2 wheels.

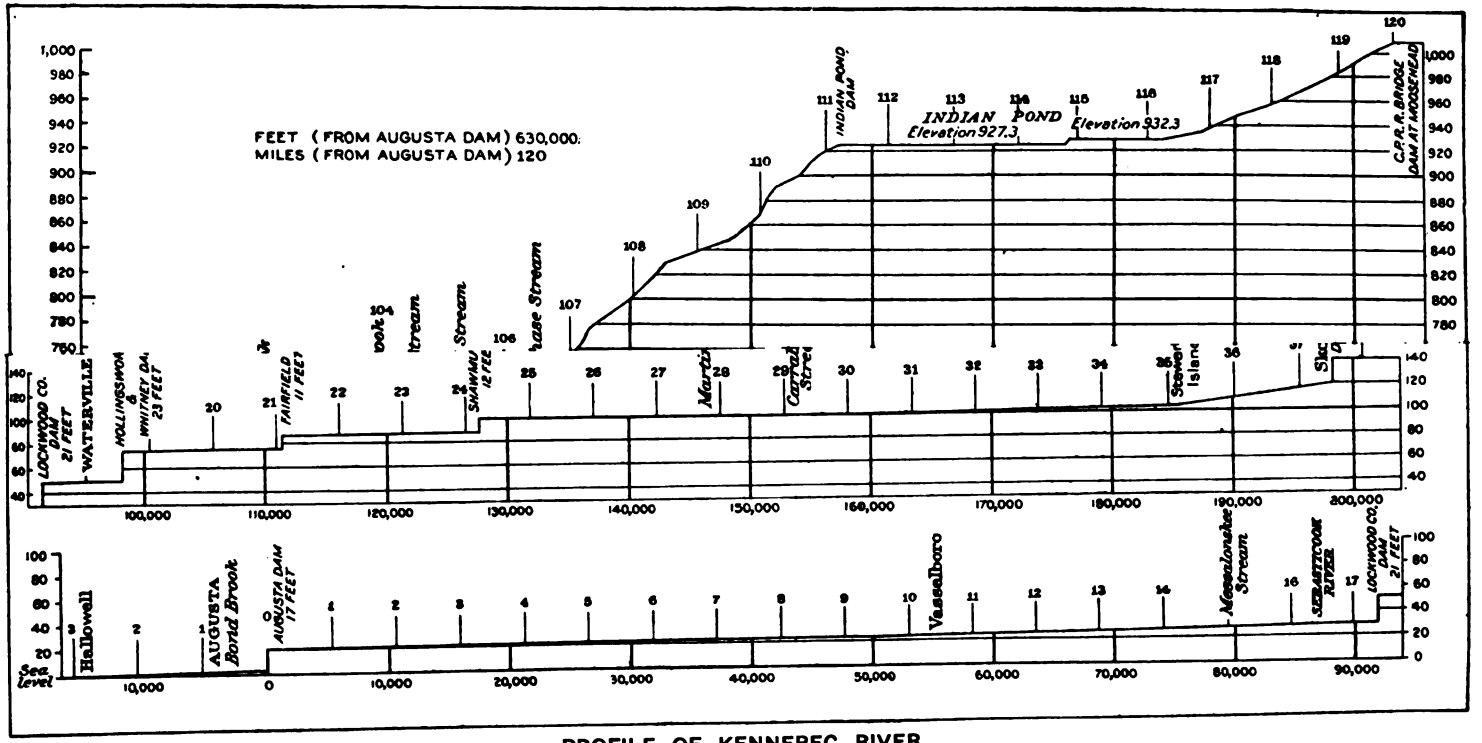
UNDEVELOPED WATER POWERS.

GENERAL CONSIDERATIONS.

In 1882 Swain[a] called attention to the large amount of excell[illegible] undeveloped power on the Kennebec River and its tributaries. Sin[illegible] that time many important plants have been constructed—notabl[illegible] those at Waterville, Fairfield, Madison, and Solon on the main river a[illegible] numerous smaller developments on the tributary streams. There still, however, especially in the more northerly portions of the bas[illegible] an immense amount of unutilized power. Of the 1,026 feet fall on t[illegible] main river between Moosehead Lake and tide water only about 1 feet are developed. A condensed profile of Kennebec River is sho[illegible] on Pl. IV; a plan and a more detailed profile can be obtained addressing the Director of the United States Geological Surv[illegible] Washington, D. C.

Brief descriptions follow of some of the more important unutil[illegible] water privileges. For the main stream and for Moose, Roach, Dead rivers these are based on surveys and reconnaissances of

[a] Swain, G. F., Report on water powers: Tenth Census, vol. 16, pt. 1, 1885, pp 83-89.



PROFILE OF KENNEBEC RIVER.

Corrected according to revised datum of 1906, by adding 2.6 feet to all elevations.

nited States Geological Survey from 1904 to 1906; for the principal ibutaries such topographic atlas sheets as are available were con-lted, and the facts they furnished were supplemented by informa-on obtained chiefly through correspondence.

KENNEBEC RIVER.

Between Moosehead Lake and Indian Pond there is a drop of nearly 0 feet distributed rather evenly over a distance of about 3½ miles. For about 7 miles below Indian Pond the river is very precipitous, ling approximately 250 feet. Much power could be developed here. e banks are high with rocky walls and there are many excellent n sites. In the remaining 8 miles to the mouth of Dead River at e Forks, the fall is a little less steep, amounting to about 120 feet. e conditions in general are good, however, for power development. From The Forks to Bingham the fall is in general fairly uniform, ounting to 230 feet in a distance of about 22 miles. At only a few ces in this stretch are there rapids other than those produced by general slope of the river. The most promising place for power elopment is perhaps near Carrying Place Rips, about 10 miles ve Bingham, where there is a fall of about 9 feet in half a mile; but s location is not especially favorable for a dam. This entire section he river, however, will be in time of great value for power purposes. From Bingham down to the Solon dam the fall is considerably less n in the stretch of the river just described, amounting to only about feet in a distance of 5 miles to the Solon mill pond. Between the t of the Solon dam and Solon Ferry, a distance of 1½ miles, is a fall about 8½ feet. The total fall between the foot of the Solon dam l the mouth of Carrabassett River, which marks the practical ent of pondage from the Madison dam, is about 36 feet in a distance) miles.

At Madison, between the present dam and the mouth of Sandy er, a distance of a little less than 3 miles, there is a fall of about 68 in pitches and rapids where some excellent undeveloped power ts. (See Pl. VII, *B*, p. 162.) The Great Northern Paper Company prepared plans for the development of practically all of this fall the use of two dams—one developing 43 feet and the other 20 feet. At Bombazee Rips, about 2½ miles above Norridgewock, there is a of 7½ feet in one-fourth of a mile. Near the head of the rips is a d ledge foundation for a dam, and probably a 10 or 12 foot head ld be obtained here without difficulty. Just below Skowhegan re are 18 or 20 feet of undeveloped fall in a distance of about 2½ es. The remainder of the river is entirely developed.

MOOSE RIVER.

Holeb Falls, about 16 miles by river below the outlet from Holeb Pond, give a fall of 20 to 30 feet. Upstream for about 8 miles the fall is slight, so that good pondage could be had here. Mosquito Rips (4 feet fall), Spencer Rips (5 feet fall), and Attean Falls (10 feet fall) occur in the remaining stretch of river to the head of Attean Pond. The total distance from Holeb Outlet to Attean Pond is about 29 miles. Between Attean, Wood, and Long ponds there is but little fall. Below Long Pond the fall is very steep, being about 110 feet in a distance of 4 miles to Little Brassua Lake, which is practically at the level of Brassua Lake. This stretch flows over a very rough and rocky bed and there are several good sites for dams. (See Pl. V, *B*.) Between Brassua and Moosehead lakes is a drop of about 20 feet at ordinary stages. By placing a dam near the Rockwood gaging station of the United States Geological Survey this fall could be practically all utilized and in addition any further amount resulting from the raising of the Brassua Lake level to procure additional storage. (See p. 134.)

ROACH RIVER.

There is a little fall on Roach River above Lower Roach Pond—perhaps 30 feet to Middle Roach Pond. Between Lower Roach Pond and Moosehead Lake, a distance of some 5 miles, the fall is about 75 feet.

MOXIE STREAM.

There is a total fall of 370 feet between Moxie Pond and Kennebec River, a distance of about 4 miles, and this occurs practically all in the lower 2 miles. At Moxie Falls there is a nearly vertical drop of 95 feet near the main river.

DEAD RIVER.

At Arnolds Falls about 5 miles below Flagstaff there is a fall of about 12 feet in one-fourth of a mile. At Hurricane Falls, 4 miles above Dead River, there is a fall of 8 feet in one-eighth of a mile. From 10 to 12 feet fall could be developed, but the pondage would be small, unless the intervale land was flooded. Long Falls, 6 miles below Dead River Plantation, extends over a distance of about a mile, with a total fall of about 72 feet, the main part being made up of a series of precipitous falls occurring in a short distance. Excellent sites exist for a dam, as the river banks are of ledge, and a 40-foot head could be easily developed. At Grand Falls, one-fourth mile below the Dead River dam and about 12 miles from The Forks, is a precipitous drop of 28 feet. The banks are high and of ledge, affording an excellent opportunity for a dam; a 40-foot head could

A. HEAD-GATES AT EAST OUTLET OF MOOSEHEAD LAKE.

B. LONG POND DAM ON MOOSE RIVER.

developed. Dead River Rapids extend from Grand Falls 'orks, with a total fall of about 400 feet in the 12 miles. No us falls occur, but for the most part a gradual descent is ed, there being a succession of very rocky rapids with short of connecting quick water. The river banks are for the t high and ledges are numerous affording opportunities for nearly all of the rapids.

llowing table gives an approximate profile of Dead River, a barometric reconnaissance during 1906.

Elevations along Dead River.

[Datum is mean tide.]

Place.	Elevation above mean sea level.	Approximate distance from Flagstaff.
	Feet.	*Miles.*
.....	1,082	.....
.....	1,072	10
st Carry Pond	1,072	14½
g Falls	1,072	16
; Falls at Black Brook	1,060	17
ing Lake	1,000	18¾
lam (present water surface)	1,000	23
lam (top gates)	1,011	23
lam (foot of Grand Falls)	983	23¼
ncer Stream	957	23½
ipencer and Little Spencer streams	984	.....
chanted Stream	760	29
h Kennebec	565	36

PLEASANT POND STREAM.

nt Pond Stream falls about 780 feet between Pleasant Pond nebec River, a distance of 3½ miles, but the tributary drainage nly a few square miles.

PIERCE POND OUTLET.

Pond Outlet falls about 640 feet in a distance of 3 miles rce Pond to Kennebec River. The drainage area at the out- pond is small, being only about 18 square miles. The pos- f bringing Dead River water to Pierce Pond and thus utiliz- arge drop to Kennebec River in one fall has been investigated. 'ond lies at about 1,125 feet above tide (by aneroid from k), and a comparison of this elevation with those given for ver in the foregoing table indicates the impossibility of carry- this scheme without great expense, as to reach the Pierce vation it would be necessary to pond the water in Dead River at above Flagstaff.

CARRABASSETT RIVER.

There is considerable undeveloped fall in the upper part of Carrabassett River and on its tributaries, but the supply of water is in general too small to warrant developments. At Cleveland Rips, 3 or 4 miles above North Anson, is an undeveloped fall said to be about 12 feet.

SANDY RIVER.

Considerable undeveloped fall exists on Sandy River. There is said to be a good privilege just below New Sharon that will afford a fall of about 30 feet. At Davis Ferry, in the town of Stark, is a power site with perhaps a 15-foot fall. At Strong, and farther up the river, there is considerable unutilized fall, but the volume of water available in low-water seasons is small.

SEBASTICOOK RIVER.

Sebasticook River is one of the most fully developed for power of all the tributaries of the Kennebec. Of the 170-feet fall between Moose Pond and Kennebec River about 100 feet are developed. It is said that at Fifteenmile Rips, about 3 miles above Clinton, a good site exists to obtain a fall of about 12 feet. At Winslow, about half a mile below the entrance of China Lake Outlet, near the mouth of the river, is an undeveloped privilege owned by the Fort Halifax Paper Company, of Waterville, that is reported to be capable of affording a 24-foot head and "a mean low run of 450 to 550 cubic feet per second."

MESSALONSKEE STREAM.

Of the 210-feet fall between Messalonskee Lake and Kennebec River about 135 feet are developed. A good unutilized site remains just below Oakland, where a head of about 47 feet can be obtained. This is owned by the Messalonskee Electric Company. The large amount of lake area in this drainage basin is of great value in rendering the flow uniform, but the storage capacity of the lakes should be increased and more care given toward regulation of flow.

WEBER POND OUTLET.

Weber Pond Outlet falls about 115 feet in 3½ miles—mostly in the last 2 miles—from Weber Pond to Kennebec River.

COBBOSSEECONTEE STREAM.

Cobbosseecontee Stream is rather fully developed, but a few unutilized sites remain above Cobbosseecontee Pond. This is a stream of very even flow, owing to its excellent storage reservoirs.

WATER STORAGE.

GENERAL CONSIDERATIONS.

ɔther tract of country of the same extent on the continent is so vatered—that is, supplied with well-distributed lakes and ıs—as is the State of Maine. Of the three largest drainage in the State—the Kennebec, Penobscot, and Androscoggin—ɜnnebec is first as regards the proportion of lake and pond sur-ɔ total drainage area, which for this river is about 1 to 14. . 144.) Moreover, Moosehead Lake furnishes one-third of this surface area in the Kennebec basin and constitutes one of the ʻaluable reservoirs for water storage and control in the country. ʻainage area tributary to Moosehead Lake is large—about 1,240 miles—so that even the great storage capacity afforded by a of 7.5 feet (the present head) on this lake is not nearly sufficient ɤent considerable losses of water at times.

importance of storing and regulating the flow of Kennebec has long been realized by the water power and lumbering inter-ong the river. To a certain extent these interests of necessity t in regard to the manner of use of stored water. The log-ɡ season begins in the early spring, the small streams in the aters being first driven and the logs temporarily held in various ınd ponds. Eventually the main drive leaves Moosehead Lake, is usually well into the summer before the last of the logs reach lestination on the lower river. To drive the logs, especially in rtion of the river between Moosehead Lake and Bingham, a cer-mount of flow is required to prevent the rapid formation of and the practice is to let out each day from Indian Pond dam ɔond being used as a regulating reservoir for flow from Moose-Lake) a head, or "hoist," as it is called, of water to help sluice the drive. Formerly little or no care was taken to prevent the of water during log driving, with the result that frequently by ıd of the log-driving season little water would be left stored in head Lake, and consequently the water-power users on the river ɜd from a scarcity of water in the fall and early winter, receiving t no benefit from the use of Moosehead Lake for storage. In ɜars, however, the log-driving and water-power interests on the ıave become more harmonious, and the two associations repre-ɡ them—the Kennebec Log Driving Association and the Ken-Water Power Company—are to a large extent made up of the persons. Efforts are being made not only to prevent the need-aste of water in log driving, but to improve the river channel and ies for driving, so as to require less water for this purpose. The ity of providing additional storage capacity over that now ɜd at Moosehead Lake has been apparent for several years, and

surveys of the lake have been made by the water-power company to ascertain the feasibility of further raising the lake level.

As a result of the cooperation between the Maine State Survey Commission and the United States Geological Survey, surveys of various lakes and ponds in the Kennebec headwaters were made during 1905–6 by the National Survey. Sufficient information has been thus obtained, in addition to that relating to Moosehead Lake furnished by the Kennebec Water Power Company, to serve as a basis for a fairly comprehensive study of the problem of additional storage, and in the succeeding pages the various possibilities will be discussed. The following plans and profiles will be furnished to persons especially interested in the subject on application to the Director, United States Geological Survey, Washington, D. C.:

Plan of Brassua Lake.
Plan of Brassua Lake Outlet.
Plan and profile of Moose River between Moosehead and Brassua lakes.
Plan of Wood and Attean ponds.
Plan of Wood Pond Outlet.
Reconnaissance plan of Holeb Pond, Long Pond, Lower Roach Pond, Middle Roach Pond, Flagstaff Lake, West Carry Pond, Spring Lake, and Spencer Ponds.

STORAGE IN KENNEBEC HEADWATERS.

MOOSEHEAD LAKE.

Moosehead Lake, with an area of about 115 square miles, is the largest lake in New England. It is about 35 miles in extreme length, 12 miles in maximum width, and of such depth that it is crossed by steamboats from end to end. It has long been used as a reservoir to store the spring flow for use in log driving and for power, and is commanded by substantial log-crib dams at its two outlets. That at the east or principal outlet, shown in Pl. V, *A*, was completed in 1901, replacing an old dam. The west-outlet dam was rebuilt in 1904. Most of the regulation of flow, however, is carried on at the east-outlet dam, and in general little water flows by way of the west outlet. The west-outlet stream joins the main river at the upper end of Indian Pond.

The present head of water obtainable on Moosehead Lake is about 7.5 feet. (See list of gage heights of Moosehead Lake, pp. 70–76.) The Kennebec Water Power Company has made surveys of the present lake shores with the view of obtaining additional storage capacity corresponding to an increased depth of 2 feet, and has spent about $16,000 for these surveys and mapping. The results indicate that an increase in water surface of about 1.6 square miles would result from this proposed rise in level. The shores are in general high and rocky, but in several places rather low, so that the estimated damages are on the whole considerable. It is probable that Moosehead Lake could

be drawn down considerably below the present limit, if dredging were done at the outlet, but this would of course have an objectionable effect on the navigability of the lake.

The data furnished by the Kennebec Water Power Company have been used in compiling the following table, which shows the present storage capacity and that obtainable by raising the lake level 2 feet.

Area and capacity of Moosehead Lake at different elevations.[a]

[Drainage area at outlet, 1,240 square miles.]

Gage height.	Area of water surface.	Capacity of section.	Total capacity above gage height 0.0 foot.
Feet.	*Sq. miles.*	*Cubic feet*	*Cubic feet.*
0.0	111.3		
1.0	111.9	3,110,000,000	3,110,000,000
2.0	112.4	3,127,000,000	6,237,000,000
3.0	113.0	3,142,000,000	9,379,000,000
4.0	113.6	3,158,000,000	12,537,000,000
5.0	114.3	3,176,000,000	15,713,000,000
6.0	114.9	3,195,000,000	18,908,000,000
7.0	115.6	3,213,000,000	22,121,000,000
7.5	116.0	1,614,000,000	23,735,000,000
8.5	116.8	3,245,000,000	26,980,000,000
9.5	117.6	3,267,000,000	30,247,000,000

[a] Gage heights refer to lake datum, the zero of which is approximately at the elevation of the gate sills, or 1,021.30 feet above mean sea level.

MOOSE RIVER BASIN.

Moose River and its series of lakes, comprising Brassua Lake and Long, Wood, Attean, and Holeb ponds, afford some excellent opportunities for storage of water. The natural and artificial conditions in the vicinity of these ponds are in general favorable for their utilization for storage without great cost, but at present only one of them (Long Pond) is controlled by a dam, and this is utilized solely for log-driving purposes. (See Pl. V, *B* p. 128.) The following descriptions of the Moose River lakes and ponds are based on data obtained by the United States Geological Survey during 1905–6, as previously explained.

BRASSUA LAKE.

Brassua Lake is approximately rectangular in shape, running northwest to southeast, about 5.5 miles long and 1.4 miles in maximum width. Its greatest depth is about 35 feet, in the extreme northwestern part of the lake; the more shallow portions lie at the southeastern extremity along Miseree Sands. It has an area of 5.55 square miles at an elevation of 1,043.0 feet above mean tide. The shores are wooded and as a rule are high, the low areas being around the entering streams—Miseree Stream at the southeast, Moose River at the south, and Brassua Stream at the northern extremity. No dam now exists at the outlet of the lake.

This lake could readily be raised 10 or 15 feet, or even more, above the present low-water level, without doing any damage except to timber standing on the flooded area, but as this is mostly young growth the total damage would be small. There are several good sites for a dam at the outlet of the lake. As a rule the river bed here is rocky or of gravel and in places rather rough.

A dam with crest at elevation 1,056 feet, placed near the outlet, with a total length of about 850 feet and a maximum height of 20 to 25 feet would afford about 18 feet head of water.

About 1.3 miles below the outlet, just below the United States Geological Survey gaging station, is a site for a dam which would not only afford lake storage but would develop a fall of about 25 feet and flood out the rough section of the river intervening, which causes considerable trouble in log driving. A dam here would be about 1,000 feet in total length and about 35 feet in maximum height, if its crest were set at elevation 1,056 feet.

The following table gives the area and approximate storage capacity of Brassua Lake at various elevations:

Area and capacity of Brassua Lake at different elevations.

[Drainage area at outlet, 675 square miles.]

Elevation above mean sea level.	Area of water surface.	Capacity of section.	Total capacity above elevation 1,038 feet.
Feet.	*Sq. miles.*	*Cubic feet.*	*Cubic feet.*
1,038	4.45		
1,039	4.66	127,000,000	127,000,000
1,040	4.87	133,000,000	260,000,000
1,041	5.08	139,000,000	399,000,000
1,042	5.30	145,000,000	544,000,000
1,043	5.55	151,500,000	695,500,000
1,044	5.80	158,500,000	854,000,000
1,045	6.05	165,000,000	1,019,000,000
1,046	6.35	173,000,000	1,192,000,000
1,047	6.65	181,000,000	1,373,000,000
1,048	7.00	190,500,000	1,563,500,000
1,049	7.37	200,000,000	1,763,500,000
1,050	7.85	212,000,000	1,975,500,000
1,051	8.37	236,000,000	2,211,500,000
1,052	8.85	240,500,000	2,452,000,000
1,053	9.20	252,000,000	2,704,000,000
1,054	9.50	261,000,000	2,965,000,000
1,055	9.80	269,000,000	3,234,000,000
1,056	10.12	278,000,000	3,512,000,000
1,057	10.45	287,000,000	3,799,000,000
1,058	10.70	295,500,000	5,094,500,000

LONG POND.

Long Pond runs approximately from northwest to southeast and is long, narrow, and irregular in shape. Its extreme length is about 10 miles, 8 miles being the pond proper and the remainder the former river channel, in which water is held by the dam. During low water there is a fall of perhaps 2 or 3 feet between these two portions. The width of the pond varies from 300 feet at the Lower Narrows to

miles opposite the mouth of Parlin Stream. Its maximum depth about 35 feet, and it has a pond surface of 4.8 square miles at an vation of 1,159 feet.

The shores are wooded, as a rule, with some bordering farm land ard the northern extremity. Around the upper end the ground ow and marshy; the remainder of the shore rises gradually. The adian Pacific Railway runs along the entire southern shore, being little above the pond in elevation. The lowest portion of the k is just west of Parlin Stream, where the elevation is about 1,165 ; at several other places the elevation is from 1,166 to 1,170 feet. he existing dam is an old timber-crib structure, 385 feet in total gth. It has two wing walls, one 43 feet and the other 170 feet g, and the dam proper is 172 feet long, with 14 sluices and gates. e Pl. V, *B*, p. 128.) The elevation of the bottom of six sluices is ut 1,157 feet; of the log sluice, 1,152.2 feet; and of the remaining ices, about 1,151.2 feet. The elevation of the wing wall on the th, at which water will go to waste, is about 1,160 feet. The dam ow used for holding back water in the spring for a short time during log-driving season; after that the gates are open and free flow es place.

On account of the proximity of the Canadian Pacific Railway, per- os no increase in the height of the dam is warranted, but to utilize storage a higher summer level could be maintained. The present -water level is about 1,152 feet at the dam, or probably about 54 or 1,155 in the pond proper. In the spring the water is main- ned for a short time in the pond at an elevation of over 1,160 feet, l an elevation of 1,160 feet could probably be maintained without ng much damage. If the present average low-water level is con- ered as elevation 1,155 feet, and the average area 4.5 square miles, capacity at elevation 1,160 feet would be about 625,000,000 ic feet. It is probable that this quantity could be considerably eased by dredging at the narrows and lowering the gate sills at dam. The drainage area at the outlet of the pond is 520 square es.

WOOD AND ATTEAN PONDS.

Wood Pond is situated in the town of Jackman at an elevation at -water level of about 1,157 feet. It is connected with Long Pond about 7 miles of very crooked river, in which the fall is about 2 under average conditions. The pond is irregular in shape, 3.8 es in extreme length and 1¾ miles in maximum width. A con- rable portion of it is more than 30 feet in depth. The shores are ded and steep, with practically no bordering flat land.

Attean Pond is connected with Wood Pond by about three-fourths a mile of river and under normal conditions is at the same level Wood Pond. It will thus be noted that Long, Wood, and Attean

ponds are all at about the same elevation. Attean Pond is very irregular in shape, 5 miles long, 2 miles in maximum width, and about 30 feet in maximum depth. It contains many islands. The shores are wooded and high for the most part, the lowest land, which is under cultivation, being along the river connecting Wood and Attean ponds.

The Canadian Pacific Railway runs along a portion of the eastern shore of Wood Pond, crosses Moose River at its entrance into that pond, and then follows the northern shore of Attean Pond. Its lowest elevation is about 1,174 feet, just south of the bridge on Moose River.

A dam can be placed at the outlet of Wood Pond. Here the banks are high and of gravel, and the two ponds could be easily raised 10 feet by a dam 550 feet long. It is probable that water could not be drawn lower than about elevation 1,057 feet, owing to backwater influence from the river below; this would make a high-water elevation of 1,067 feet. Damage would be done to timber on the flooded land, and also to some farm land at the head of Wood Pond.

The drainage area of Wood Pond at its outlet is 320 square miles, and of Attean Pond 270 square miles. The following table gives the areas and capacity of Wood and Attean ponds at different elevations:

Area and capacity of Attean and Wood ponds at different elevations.

Elevation mean sea level.	Area of water surface.	Capacity of section.	Total capacity above elevation 1,157 feet.
Feet.	*Sq. miles.*	*Cubic feet.*	*Cubic feet.*
1,153	6.0		
1,154	6.6		
1,155	7.1		
1,156	7.3		
1,157	7.5		
1,158	7.7	211,900,000	211,900,000
1,159	7.9	217,500,000	429,400,000
1,160	8.0	223,000,000	652,400,000
1,161	8.0	223,000,000	875,400,000
1,162	8.2	225,800,000	1,101,200,000
1,163	8.4	231,400,000	1,322,600,000
1,164	8.6	237,000,000	1,569,600,000
1,165	9.0	245,300,000	1,814,900,000
1,166	9.4	256,400,000	2,071,300,000
1,167	10.0	270,400,000	2,341,700,000
1,168	11.1	295,500,000	637,200,000

HOLEB POND.

Holeb Pond, in the town of Holeb, is about 1 mile from Moose River, to which it is connected by Holeb Stream. It is irregular in shape, 3¾ miles long and 1⅛ miles in maximum width. The shores are wooded and high, except around the brooks and inlets entering the pond. The elevation of the low-water summer level is about 1,231 feet, and the area of the pond at this elevation is about 1.70 square miles; at elevation 1,241 feet the area of the water surface

ould be about 2.8 square miles. The Canadian Pacific Railway ns along the southern shore and crosses Holeb Stream just below e point where it leaves the pond, at an elevation of about 1,246 feet. During the spring freshets, when Moose River is high, the back- ter due to a ledge about 8 miles below Holeb Stream sets back to oleb Pond, and at times has flooded the railroad tracks. This ckwater causes the pond to act as a natural storage basin for a ort time in the spring.

The only suitable place for a dam would be at the Canadian Pacific dge, and could one be built here and an elevation of the lake face of 1,241 feet maintained, the capacity of the lake above vation 1,231 feet would be about 627,000,000 cubic feet. The inage area of Holeb Pond at its outlet is about 24 square miles.

ROACH RIVER BASIN.

Roach River, with its three connected ponds, affords some oppor- nity for storage, although not as good as Moose River on account its much smaller drainage area.

LOWER ROACH POND.

The present dam at Lower Roach Pond is as high as the surface the surrounding ground will admit, and could not be raised with- t considerable expense because of the lowland. This dam con- ls about an 8-foot head, and, with an average area of 4.9 square les, the present capacity is about 1,093,000,000 cubic feet. At sent the summer pond level is but little above minimum low ter, and a higher level could be maintained without doing any nage. It is probable, too, that this pond could be drawn down nsiderably lower by dredging and lowering the outlet. The drain- e area at the outlet of the pond is about 85 square miles.

MIDDLE ROACH POND.

On Middle Roach Pond is a dam now controlling 6 feet of head. e average area of the pond is 1 square mile, and with the present m the capacity is 167,000,000 cubic feet of water. The land is r around the dam, but with flashboards an increase in height of out 2 feet could be obtained without doing any material damage. is increase would add 67,000.000 cubic feet to the capacity.

SUMMARY OF STORAGE IN KENNEBEC HEADWATERS.

In the following table is a summary of the present and available storage in the upper portion of the Kennebec basin:

Summary of principal storage in Kennebec headwaters.

	Present storage.	Available storage.
	Cubic feet.	*Cubic feet.*
Moosehead Lake	23,735,000,000	30,247,000,000
Brassua Lake	0	3,512,000,000
Long Pond	625,000,000	625,000,000
Wood and Attean ponds	0	2,341,700,000
Holeb Pond	0	627,000,000
Lower Roach Pond	1,093,000,000	1,093,000,000
Middle Roach Pond	167,000,000	234,000,000
	25,620,000,000	38,679,700,000

STORAGE BELOW MOOSEHEAD LAKE.

MOXIE POND.

Moxie Pond, situated in The Forks and East Moxie townships, is about 4 miles from Kennebec River, to which it is tributary by Moxie Stream. It is long and narrow, about 8 miles in extreme length and three-fourths in maximum width, running approximately north and south. It has an area at low water of about 2.6 square miles. The shores are in general fairly high and steep, except near each end of the pond where there is considerable low ground. The shores are wooded, but mostly with small growth.

A timber-crib dam about 450 feet long controls a head of about 9 feet, at which level (about 969 feet above tide) the area of the water surface is about 3.0 square miles. This dam is used at present solely for log-driving purposes. The storage capacity of the pond is about 705,000,000 cubic feet. The outlet can be cut down about 2 feet and the dam raised 3 feet without great expense, and a total head of 14 feet obtained, corresponding to about 1,100,000,000 cubic feet capacity. To more nearly control the run-off from this drainage basin (80 square miles at the mouth of the pond) a dam 18 or 20 feet high would be required, furnishing a storage capacity of about 1,600,000,000 cubic feet. The most serious obstacle to raising the level of Moxie Pond any considerable amount is the proximity of the Somerset Railway extension, and the necessary changes involved in grading, etc., would add largely to the expense. On the other hand, the large amount of available water power on Moxie Stream, which has a fall of about 370 feet in practically 2 miles, makes any increase in the storage capacity of Moxie Pond of twofold value.

PIERCE POND.

Pierce Pond is located principally in Pierce Pond Township, about 3.5 miles west of Kennebec River, to which it is tributary by Pierce Pond Stream. It is very irregular in shape, being practically two ponds connected by a thoroughfare. It runs approximately north and south, and is 5 miles in extreme length, a little over a mile in maximum width, and in places rather deep. It has an area of about 2.3 square miles and the surface is approximately 1,125 feet above mean tide. The shores of the pond are wooded, mostly with young growth, and in the main are high with steep banks, but there are a few low places of small area.

A timber-crib dam, in rather poor condition, about 385 feet in total length, affords a head of 10 feet and a storage capacity of approximately 620,000,000 cubic feet.

The drainage area tributary to Pierce Pond is only about 18 square miles and any additional storage over the present amount is of doubtful value, although it could be obtained without great outlay. The thoroughfare between the two sections of the pond could be cut down with little expense, so that the northern part, in which at present there is a height of about 3.5 feet not utilized, would drain down within a foot of the outlet level. Pierce Pond would make an excellent storage reservoir if a greater area were tributary to it. The relative position of Pierce Pond with reference to Dead River is discussed on page 129.

DEAD RIVER BASIN.

Some very good opportunities exist for storage of water in the Dead River drainage basin, although as a rule the lakes and ponds do not have a large tributary area.

FLAGSTAFF LAKE.

Flagstaff Lake is in the town of Flagstaff, about half a mile north of Dead River, to which it is tributary. It is approximately rectangular in shape, running southeast and northwest, 2.5 miles in extreme length and 0.9 mile in maximum width, with an area of water surface of about 1.4 square miles, at an elevation of 1,100 feet above mean tide. It is a shallow lake, being not over 10 feet in maximum depth at medium stages. The shores are in general rather low.

A rough timber and bowlder-filled dam, situated about 2,300 feet down the outlet stream, controls a head of 12 feet, although considerably less than this amount is actually obtained, owing to the position of the gates. Power is used at this dam for running a sawmill. The storage capacity of Flagstaff Lake, with a depth of 12 feet and a water-surface area of 1.4 square miles, is about 470,000,000 cubic feet. This dam could not be raised more than 3 feet without flooding a part

of the village of Flagstaff. A dam could, however, be placed 500 feet below the lake, or 1,800 feet upstream from the present dam, where the channel is about 100 feet wide and the stream has a rocky bed. With an increase in level of 10 feet a large storage capacity could be obtained, probably as much as 2,000,000,000 cubic feet. The drainage area at the outlet of Flagstaff Lake is about 50 square miles. The possibility of utilizing this lake as a storage basin for flow from the main river should be further investigated.

WEST CARRY POND

West Carry Pond is in the town of Carrying Place, about 4 miles east of Dead River, to which it is tributary. It is regular in shape, about 2 miles in extreme length and 0.8 mile in maximum width. In places it is more than 80 feet deep. It has a water-surface area of approximately 1.3 square miles, at an elevation of 1,250 feet above mean tide, or about 180 feet above Dead River. The shores are high and wooded.

A timber-crib dam at the outlet, 600 feet in total length, controls a head of about 10 feet, which would correspond to a storage capacity of about 360,000,000 cubic feet. This level could be easily raised 10 feet or more, but the tributary drainage area is only 15 square miles, and it is stated that water has never flowed over the present dam, so that no changes seem warranted.

SPRING LAKE.

Spring Lake, in T. 3, R. 4, lies about 1 mile west of Dead River, to which it is tributary. It is long and narrow, with two deep bays, 2.6 miles in total length, 0.75 mile in maximum width, and about 60 feet in maximum depth. The water-surface area is about 1.1 square miles, at an elevation of about 1,260 feet above mean tide, or 260 feet above Dead River. The shores are high and wooded.

No dam is situated at the outlet of this pond, although a head of 10 feet could be readily controlled. The drainage area is only about 10 square miles, and probably this lake will be of little value for storage unless the topography is such that adjacent streams can be readily turned into it.

DEAD RIVER DAM.

The Dead River dam was built in the autumn of 1905 by the Dead River Log Driving Company. It is situated about 1,400 feet above Grand Falls and half a mile above the entrance of Spencer Stream. It is a timber-crib structure having a total length of about 320 feet, with two log sluices and twenty gates. It is used solely for log driving and affords a head of 13 feet, flooding the river back to the foot of Long Falls. This, however, is only for a short time in the spring.

SPENCER PONDS.

ıe Spencer ponds are situated mainly in Hobbstown, about 5 ɜ north of Dead River, with which they are connected by Little ıcer and Spencer streams. They are known as Lower Basin, er Pond, and Fish Pond, and are connected by narrow thorough-ɨ. They are long and narrow, running approximately north and h. The total length is 6 miles and the maximum width, in the r basin, 0.8 mile. The area of water surface is about 2.6 square ɜ, at an elevation of about 1,150 feet above tide, or 190 feet above l River at Spencer Stream. The shores are wooded and generally ɔ and high, except at the north end.

timber-crib dam approximately 105 feet long at the outlet of er Basin controls a head of about 12 feet, although a bar in the ım above the dam prevents the utilization of the last foot of stor-This could be easily removed and would result in a storage ıcity with the present dam of approximately 870,000,000 cubic . It is practicable to raise the level of these ponds 5 feet or more, ɜnding on the quantity of water available. A total head of 16 would afford a storage capacity of about 1,500,000,000 cubic feet. drainage area at the outlet of Lower Basin is about 46 square ɜs.

SPENCER STREAM DAM.

he Spencer Stream dam is a log-roll dam affording a head of about et, situated about 4 miles up Spencer Stream from the entrance of le Spencer Stream. It makes several small ponds that are very ɨkly filled, affording frequently three or four heads per day during log-driving season.

UPPER DEAD RIVER.

o additional data for Dead River above Flagstaff are available ɜr than those given in the summary table on page 142. It is prob-ɨ that considerable opportunity exists for storing water in this part he river, and Chain of Ponds, Jim Pond, and Tim Pond appear to vorthy of investigation in this respect.

SUMMARY OF STORAGE.

he following table, summarizing the storage in the Kennebec basin, ıken mainly from Wells's report[a] and such corrections and addi-s have been made as are possible with the data at hand. In gen-, the areas of water surface in the lower part of the basin, as given Wells, are approximately correct, but those in the middle and er parts are too large. Corrections of Wells's figures are based on topographic sheets or the results of surveys by the United States logical Survey.

[a] Wells, Walter, The Water Power of Maine, 1869, pp. 94-97.

Summary of storage in Kennebec basin.

CONNECTED WITH MOOSE RIVER.

	Approximate area.	Present storage.	Additional available storage.
	Sq. miles.	*Feet.*	*Feet.*
Brassua Lake	5.55	None	10-15.
Misery Pond	1.5	2 or more	Can be raised.
Parlin Pond	2.75	5, formerly	3.
Long Pond	5	8	
Wood Pond	3.3	None	10.
Little Big Wood Pond	1.35	7	10.
Attean Pond	4.5	None	10 by dam at outlet of Wood Pond
Holeb Pond	2	do	Can be raised by a dam at Holeb Falls.
Thorndike Ponds (2)	1	6 (one pond)	The other can be raised 6 feet.
	26.95		

CONNECTED WITH DEAD RIVER.

Spencer Ponds	2.6	12	4 or 5.
Pond in T. 5, R. 7	0.5		6.
Great Pond [a]	4		Considerable.
King and Bartlett Pond	1		
Spring Lake	1.1		10
Flagstaff Lake	1.4	12	More.
Carrying Place Pond (the largest)	1.3	10	10 or more.
Jim Pond, T. 1, R. 5	1	8	2.
Tim Pond, T. 2, R. 4	1.25	9	
Chain of Ponds (3)	5	8	2; one dam flows all.
	19.15		

CONNECTED WITH CARRABASSETT RIVER.

Fahi Pond	0.6	4	4.
Sandy Pond	.4		
Embden Pond	2.4	4	12.
Hancock Pond	1	4	Several.
Spruce Pond	.35		
Rowe Pond	.7		8.
Gilman Pond	.5	Dam	
Judkins Pond	.75		
Butler Pond	.4		
Porters Pond	1	Dam	4.
Tufts Pond	.5		Several.
Dutton Pond	.2	8	Do.
Jerusalem Pond	.3	Dam	Do.
Carrying Place Pond (middle)	.3	do	Do.
	9.1		

CONNECTED WITH SANDY RIVER.

Bog Pond	1		
Clear Water Pond	1.75	8	3.
Norcross Pond	.35		
Chesterville Ponds (6)	2	Dam	4 or 5 can be had on four ponds.
Wilton Pond [b]	1.25	7	Can raise 2 feet and lower outlet 3 feet.
North Pond	1	Dam	Can raise dam and lower outlet.
Taylor Pond	.2		
Sandy River Ponds (4)	1	2	Several.
Luflkin Pond	1.25	0	5.
Sylvester Pond	.3	Dam	
	10.1		

[a] It is uncertain whether this pond exists as given by Wells.
[b] Called Wilson Pond by Wells.

Summary of storage in Kennebec basin—Continued.

CONNECTED WITH WESSERUNSETT STREAM

	Approximate area.	Present storage.	Additional available storage.
	Sq. miles.	*Feet.*	*Feet.*
	3	7	3.
l	1	None	10.
		do	Can be made a good reservoir.
	.75	None	9.
	.6	6	
	5.35		

CONNECTED WITH SEBASTICOOK RIVER.

	6.1	6	
	.85		
	.7		
	.95	6	
Pond	4.25	2	2, by lowering outlet
	1.75		4, on 3.50 square miles.
with flowage	3	10	
	.7		
	2.5		Several.
	7.5	4	4.
	.6		
	3	8	
(2)	.6		
	.8		
th flowage	2.5	Dam	
nd	.35		
l	.4		
	.9		Can have a high dam.
	1.1		
	9.5	4	10 or more.
	.35		
	.35		
	.35		
	48.2		

CONNECTED WITH MESSALONSKEE STREAM.

ke	5.4	4–5	4, with large flowage.
	4.2	1–2	
	12.7	Dam	
	.9		
	.7		
	.35		
ponds	2.6	8	
	3.6		
	30.45		

CONNECTED WITH COBBOSSEECONTEE STREAM.

	1.1	4	3 by higher dams and 3 by cutting down the "Rips" and "Hazards" ledge.
(first)	.7	3	The three Purgatory ponds can be raised 8 feet and drawn down 4 feet.
(second)	.5	Dam	
(third)	.2		
nd	[illegible]	7	0.
	.9	4	(?) 0.
Pond	8.4	4	Can draw down and add 6 feet.
	.8		
cook	2.2	3	3.
k	2.5		
	.5		
	1.1		
	.3	0	Can be flowed.
	.3		
	.3		
	20.9		

a Called Jimmy's Pond by Wells.

Summary of storage in Kennebec basin—Continued.

CONNECTED WITH KENNEBEC RIVER ABOVE AUGUSTA.

	Approximate area.	Present storage.	Additional available stor
	Sq. miles.	*Feet.*	*Feet.*
Weber Pond	1.9	6	
Threemile Pond	1.6	8	
Sibley and Morrill ponds	2		10, on Morrill.
Long Pond	.95		
Austin Ponds (5)	3.2		All can have dams.
Robinson Pond	.75		
Pleasant Pond	1.6	4	8.
Mores Bog Stream Pond (Carritunk)			
Otter Ponds (2)	.5		
Chase Ponds (3)	1		
Mosquito Pond	1		12.
Moxie Pond	2.6	9	5 or more.
Lower Baker Pond	1		
Black Brook Pond	.5	8	2.
Knights Pond	.2	7	2.
Pierce Pond	2.3	10	Good reservoir.
Carrying Place Pond (Lower)	1	0	High dam.
Cold Stream Pond	1.25		12.
Chase Stream Pond	.6		
Indian Pond	1.5	12	
Moosehead Lake	115	7.5	2.
Lower Roach Pond	5	8	4.
Middle Roach Pond	1.5	6	2.
Upper Roach Pond	1.5	Poor dam	
Tomhegan Pond	.75	No dam	6.
Spencer Pond	1.5	4	
West Outlet Ponds (3)	1.25	Dam feasible.	
	152.45		

CONNECTED WITH KENNEBEC RIVER BELOW AUGUSTA.

Nequasset Pond	0.6		
Togus Pond	1	Dam	10.
Small ponds in Augusta	1.5		
Gardiner Ponds	.9		
	4		

a Called Great Swamp in Dresden by Wells.

Summary of areas of principal lakes and ponds in Kennebec basin.

	Squ mil
Moose River	2
Dead River	1
Carrabassett River	
Sandy River	1
Wesserunsett Stream	
Sebasticook River	4
Messalonskee Stream	3
Cobbosseecontee Stream	2
Kennebec River above Augusta	15
Kennebec River below Augusta	
Total (152 lakes and ponds)	32
Total as given by Wells	35

Wells gives a total lake and pond surface area in the Kenne basin of about 450 square miles. It is probable, in view of such p tial corrections as have been made in the foregoing tables, that total area of lakes and ponds is not over 420 square miles, or 1 squ mile to each 14.2 square miles of total drainage area.

EFFECT OF PRESENT STORAGE ON FLOW.

The measurements of flow in the Kennebec basin by the United States Geological Survey have been carried on since about 1901; records of flow at Waterville since 1892 and records of height of water surface of Moosehead Lake since May, 1895, have been kept by the Hollingsworth & Whitney Company, so that some idea can be derived as to the amount of storage obtained at this lake and its effect on the flow of Kennebec River.

The following table gives the monthly mean run-off as observed at Waterville, North Anson, and The Forks and the estimated run-off without storage in Moosehead Lake. The corrections were obtained for any given monthly flow by computing the quantity of water corresponding to the change in lake level during the month, reducing this to an equivalent mean flow in second-feet, and dividing this result by the drainage area at the point considered. This correction was added to the observed run-off if the lake level rose during the month and subtracted if the lake level fell. The results thus obtained are not strictly the run-off that would have resulted had there been no storing of water in Moosehead Lake, as during the time of storage some water evaporates that would appear as run-off if no water were held back. In this form, however, the results obtained are suitable for computations regarding storage, as evaporation is thus taken into account on the present water-surface area, and as the increase in this area due to raising the level for additional storage is not generally of large percentage value we may consider that for all practical purposes allowance has been made for evaporation from the water surface of the present storage reservoirs (mainly Moosehead Lake; see table on p. 133). From any new reservoirs, such as Brassua Lake and Attean and Wood ponds, there would be an increased amount of evaporation due to the water being held for a longer time than is done at present; but, on the other hand, the ground storage of water in the vicinity of all these lakes and ponds would be greatly increased, and it is probable that these two factors would largely offset each other. In the following estimates of additional storage capacity it will be considered that evaporation from water surface of the storage reservoirs has been taken into account in the figures used for run-off:

Effect of storage of water in Moosehead Lake on flow at Waterville, North Ar The Forks.

Month.	Flow in second-feet per square mile of drainage area.				
	Waterville (drainage area 4,270 square miles).		North Anson (drainage area 2,790 square miles).		The Forks area 1,57(miles).
	Observed flow.	Estimated flow without storage.	Observed flow.	Estimated flow without storage.	Observed flow.
1895.					
January	0.48				
February	.42				
March	.47				
April	5.60				
May	2.24	2.62			
June	1.50	.80			
July	.82	.59			
August	.63	.38			
September	.42	—.04			
October	.29	.41			
November	1.31	1.84			
December	1.41	1.94			
1896.					
January	1.01	1.23			
February	.66	.53			
March	3.07	3.24			
April	6.42	6.99			
May	3.99	3.68			
June	1.29	.90			
July	1.25	.88			
August	.74	.32			
September	.80	.73			
October	.86	1.01			
November	2.12	2.79			
December	.64	.63			
1897.					
January	.84	.82			
February	.87	.70			
March	.93	.89			
April	5.94	6.79			
May	6.30	6.53			
June	3.04	2.65			
July	3.07	2.94			
August	1.71	1.35			
September	1.07	.67			
October	.62	.56			
November	1.33	1.47			
December	1.25	1.62			
1898.					
January	.75	.74			
February	.80	.69			
March	2.64	2.35			
April	6.98	8.02			
May	5.88	5.92			
June	2.34	1.83			
July	.92	.36			
August	.73	.36			
September	.61	.54			
October	.95	1.11			
November	1.21	1.54			
December	.61	.75			
1899.					
January	.55	.48			
February	.55	.37			
March	.75	.71			
April	5.62	6.41			
May	4.98	5.22			
June	2.06	1.54			
July	1.19	1.08			
August	.77	.47			
September	.43	.06			
October	.30	.15			
November	.53	.54			
December	.64	.74			

storage of water in Moosehead Lake on flow at Waterville, North Anson, and The Forks—Continued.

Month.	Flow in second-feet per square mile of drainage area.					
	Waterville (drainage area 4,270 square miles).		North Anson (drainage area 2,790 square miles).		The Forks (drainage area 1,570 square miles).	
	Observed flow.	Estimated flow without storage.	Observed flow.	Estimated flow without storage.	Observed flow.	Estimated flow without storage.
1900.						
	0.56	0.57				
	2.12	2.50				
	2.14	2.28				
	6.66	7.50				
	6.62	6.87				
	2.35	1.96				
	1.35	1.20				
	.98	.53				
	.66	.26				
	.72	.65				
	1.49	1.88				
	.96	.96				
1901.						
	.74	.59				
	.58	.42				
	1.13	.90				
	9.63	11.24				
	3.55	3.42				
	1.93	1.52				
	1.20	.75				
	.98	1.02				
	.66	.34				
	.68	.40			1.01	0.22
	.56	.41			.89	.47
	2.79	3.38				
1902.						
	.90	1.07				
	.89	.74				
	6.73	7.01			2.08	2.83
	5.19	6.09	5.29	6.67	6.37	8.82
	3.95	3.98	4.99	5.03	6.05	6.13
	3.57	3.47	4.58	4.42	6.11	5.83
	1.83	1.39	2.06	1.91	3.86	2.52
	1.18	.93	1.50	1.12	1.87	1.18
	.99	.96	1.25	1.21	1.04	.96
	1.23	1.23	1.31	1.31	.91	.91
	1.06	1.31	1.30	1.68		
	1.02	.94				
1903.						
	.94	.94				
	.93	.64				
	4.54	5.28			2.08	4.08
	3.85	3.92	4.22	4.33	5.32	5.52
	1.70	1.63	2.62	2.51	2.26	2.06
	1.57	1.32	2.06	1.67	2.72	2.05
	1.22	.82	1.45	.85	2.93	1.85
	.91	.69	1.31	.97	1.78	1.18
	.50	.16	1.00	.35	1.21	.05
	.45	.19	.70	.32	.71	.00
	.34	.22	.52	.32	.44	.09
	.32		.36			
1904.						
	.23		.25			
	.22		.24			
	.89		.33			
	3.50		2.67			
	4.85	6.36	5.10	7.42	3.22	7.34
	1.94	1.62	2.76	2.27	4.15	3.28
	1.25	.10	1.88	1.50	3.60	2.92
	1.10	.71	1.46	.87	1.89	.83
	1.00	1.12	1.29	1.46	1.35	1.66
	1.10	1.36	1.46	1.86	.10	.72
	.79	.74	1.09	1.02	.85	.73
	.64	.42	.99	.64		

Effect of storage of water in Moosehead Lake on flow at Waterville, North Anson, and The Forks—Continued.

Month.	Flow in second-feet per square mile of drainage area.					
	Waterville (drainage area 4,270 square miles).		North Anson (drainage area 2,790 square miles).		The Forks (drainage area 1,570 square miles).	
	Observed flow.	Estimated flow without storage.	Observed flow.	Estimated flow without storage.	Observed flow.	Estimated flow without storage.
1905.						
January	0.72	0.14	0.95	0.07		
February	.62	.34	.74	.32		
March	1.23	1.37	1.47	1.68		
April	3.16	3.99	3.74	5.01	1.06	3.32
May	2.46	3.07	3.12	4.06	2.76	4.43
June	1.57	1.35	2.52	2.19	3.44	2.85
July	1.09	.71	1.97	1.39	2.59	1.57
August	.75	.32	1.04	.38	1.32	.16
September	.70	.47	.71	.36	.80	.18
October	.41	.21	.43	.12	.55	−.01
November	.54	.40	.48	.27	.54	.15
December	.48	.35	.91	.70		
1906.						
January	.75	.75	.60	.60		
February	.53	.62	.44	.58		
March	.54	.54	.44	.44		
April	4.02	4.62	2.55	3.44		
May	5.22	6.50	4.75	6.71	4.75	8.24
June	2.99	2.84	2.67	2.45	3.65	3.25

The effect of present storage in Moosehead Lake is clearly shown by the above table, the maximum spring flow being considerably less than would have been the case if no water had been held back. During the summer and fall months the flow has been very materially helped out by the stored water. From December, 1903, to February, 1904, inclusive, and again during January, 1906, practically all the lake storage was exhausted and the flow through the lake was probably a natural one.

WATER AVAILABLE IN KENNEBEC HEADWATERS.

GENERAL DISCUSSION.

The figures of run-off in the table last given furnish a fairly satisfactory basis for an estimate of the quantity of water available in the Kennebec headwaters. For the ordinary year there is enough run-off from that portion of the Kennebec basin which is tributary to Moosehead Lake to fill the lake and to provide a good flow during the late summer and fall, but there will occasionally be a year—perhaps two or more years in succession—when this will not be true. It is therefore necessary to consider the run-off over a series of years in order to see what flow may occur during the low-water season and to ascertain what quantities of water must be stored to insure any given flow at all times.

The following estimates and conclusions are based primarily on the flow at Waterville, as these data comprise the only records available

that extend over a considerable term of years. The records of flow at the other gaging stations, however, furnish a means of comparing the Waterville flow with that in other parts of the basin, and enable reasonably good estimates of the flow at Moosehead Lake Outlet to be made.

A comparison of the flow from different parts of the Kennebec basin will first be made for the months of July to October, inclusive, as records are more generally available for these summer months. The following table gives the run-off from various portions of the basin and the ratio to it of the flow at Waterville:

Run-off in second-feet per square mile at various points in Kennebec basin compared with run-off at Waterville.[a]

JULY TO OCTOBER, INCLUSIVE, 1903-1905.

River and station.	Drainage area.	Average run-off per square mile.	Ratio of run-off at Waterville to that at given station.
	Sq. miles.	*Second-feet.*	
Moose at Rockwood	680	0.77	0.84
Roach at Roach River	85		
Kennebec at The Forks	1,570	1.01	.64
Kennebec at The Forks	1,570	93	.70
Dead at The Forks	870		
Kennebec at North Anson	2,790	.87	.75
Carrabassett at North Anson	340	.67	.97
Sandy at Madison	650		
Kennebec at Waterville	4,270	.65	1.00

MAY TO OCTOBER, INCLUSIVE, 1902-1905.

Kennebec at The Forks	1,570	2.15	0.68
Kennebec at North Anson	2,790	1.50	.77
Kennebec at Waterville	4,270	1.46	1.00

YEARS 1904-5.

River and station.	Drainage area.	Year.	Average run-off per square mile.	Ratio of run-off at Waterville to that at given station.
	Sq. miles.		*Second-feet.*	
Kennebec at North Anson	2,790	1904	1.71	0.89
		1905	1.38	.77
		Mean	1.54	.83
Kennebec at Waterville	4,270	1904	1.52	1.00
		1905	1.06	1.00
		Mean	1.29	1.00

[a] In this table the run-off at The Forks, North Anson, and Waterville on Kennebec River is corrected for storage in Moosehead Lake, as previously explained.

The above table clearly indicates that the run-off per square mile of drainage area is considerably greater in the upper part of the basin and that on the main river the increase is fairly uniform toward the north.

The flow on Kennebec River at The Forks may be taken as fairly representative of that at Moosehead Lake Outlet, as the outlet is

only about 23 miles above The Forks and the respective drainag areas are 1,240 and 1,570 square miles.

The average flow at Waterville for the four summer months, 1903 1905, is 0.64 of that at The Forks, and for the six months May t October, inclusive, 1902–1905, it is 0.68 of that at The Forks. Prob ably for the whole year (see ratios for North Anson) this ratio woul be somewhat higher, and it will be assumed that the unit run-off a Waterville is 0.75 of that at Moosehead Lake outlet.

The method used for computing the amount of water available o the Kennebec headwaters is that used by W. Rippl[a] and adopte by Desmond FitzGerald in a report to the city of Boston on th "storage capacity of the Sudbury River and Lake Cochituate wate sheds," modified for different conditions by Walter H. Sawyer, C. E. Rippl's method is adapted for the storage of water for municip purposes, where water is taken from the reservoir and led to th point of consumption with no further addition to its quantity. O the Kennebec, however, between Moosehead Lake and the point along the river where power is used, there is a large tributary drai age area that must be taken into account. Another requiremer must also be kept in mind on this river, viz, the use of the water t drive logs, so that it must not fall below a certain amount durin the driving months anywhere on the river below Moosehead Lak outlet. The amounts of water used for this purpose during 1904 1906 are given on page 164.

The following table shows the water available for storage in Moos head Lake from 1902 to 1906. The computations are based on minimum flow of 3,500 second-feet at Waterville and a flow of 3,00 second-feet from Moosehead Lake during the log-driving seaso (May, June, and July).

[a] Proc. Inst. Civil Eng., vol. 71, 1882-83, pp. 270-278.
[b] Storage of Water on Androscoggin River, 1905, unpublished.

Water available for storage in Moosehead Lake.

	2	3	4	5	6	7	8	9	10
	Run-off in second-feet per square mile at Waterville.	Run-off in second-feet per square mile at Moosehead Lake.	Discharge at Waterville, in second-feet.	Discharge into Moosehead Lake, in second-feet.	Discharge between Moosehead Lake Outlet and Waterville, in second-feet.	Necessary discharge from Moosehead Lake, in second-feet.	Surplus (+) or deficit (−) at Moosehead Lake.		Water available for storage, billion cubic feet.
							Second-feet.	Billion cubic feet.	
to 1...									314.50
....	1.07	1.42	4,570	1,760	2,810	690	+ 1,070	+ 2.77	317.27
....	.74	.99	3,160	1,230	1,930	1,570	− 340	− .78	316.49
....	7.01	9.33	29,800	11,570	18,230	0	+11,570	+30	346.49
....	6.09	8.10	26,000	10,050	15,950	0	+10,050	+26.05	372.54
....	3.98	5.30	17,000	6,580	10,420	3,000	+ 3,580	+ 9.28	381.82
....	3.47	4.62	14,820	5,740	9,080	3,000	+ 2,740	+ 7.10	388.92
....	1.34	1.78	5,720	2,210	3,510	3,000	− 790	− 2.04	386.88
....	.93	1.24	3,970	1,540	2,430	1,070	+ 470	+ 1.22	388.10
....	.96	1.28	4,100	1,590	2,510	990	+ 600	+ 1.55	389.65
....	1.23	1.64	5,250	2,040	3,210	290	+ 1,750	+ 4.53	394.18
....	1.31	1.74	5,590	2,160	3,430	70	+ 2,090	+ 5.42	399.60
....	.94	1.25	4,010	1,550	2,460	1,040	+ 510	+ 1.32	400.92
....	.94	1.25	4,010	1,550	2,460	1,040	+ 510	+ 1.32	402.24
....	.64	.85	2,740	1,050	1,690	1,810	− 760	− 1.97	400.27
....	5.28	7.03	22,550	8,720	13,830	0	+ 8,720	+22.60	422.87
....	3.92	5.21	16,730	6,460	10,270	0	+ 6,460	+16.72	439.59
....	1.63	2.17	6,960	2,690	4,270	3,000	− 310	− .80	438.79
....	1.32	1.76	5,630	2,180	3,450	3,000	− 820	− 2.12	436.67
....	.83	1.10	3,540	1,360	2,180	3,000	− 1,640	− 4.25	432.42
....	.69	.92	2,950	1,140	1,810	1,690	− 550	− 1.42	431.00
....	.16	.21	680	260	420	3,080	− 2,820	− 7.31	423.69
....	.19	.25	810	310	500	3,000	− 2,600	− 6.97	416.72
....	.22	.29	940	360	580	2,920	− 2,560	− 6.63	410.09
....	.32	.43	1,370	530	840	2,660	− 2,130	− 5.52	404.57
....	a.23	.31	980	390	590	2,910	− 2,520	− 6.53	398.04
....	a.22	.29	940	360	580	2,920	− 2,560	− 6.63	391.41
....	a.89	1.18	3,800	1,470	2,330	1,170	+ 300	+ .78	392.19
....	a3.50	4.66	14,950	5,790	9,160	0	+ 5,790	+15.00	407.19
....	6.36	8.46	27,150	10,500	16,650	3,000	+ 7,500	+19.42	426.61
....	1.62	2.16	6,920	2,680	4,240	3,000	− 320	− .83	425.78
....	1.00	1.33	4,270	1,650	2,620	3,000	− 1,350	− 3.50	422.28
....	.71	.94	3,030	1,160	1,870	1,630	− 470	− 1.22	421.06
....	1.12	1.49	4,780	1,850	2,930	570	+ 1,280	+ 3.32	424.38
....	1.36	1.81	5,800	2,240	3,560	0	+ 2,240	+ 5.80	430.18
....	.75	1.00	3,200	1,240	1,960	1,540	− 300	− .78	429.40
....	.42	.56	1,790	690	1,100	2,400	− 1,710	− 4.43	424.97
....	.14	.19	600	240	360	3,140	− 2,900	− 7.51	417.46
....	.34	.45	1,450	550	900	2,600	− 2,050	− 5.31	412.15
....	1.37	1.82	5,850	2,260	3,590	0	+ 2,260	+ 5.85	418.00
....	3.99	5.31	17,050	6,590	10,460	0	+ 6,590	+17.18	435.18
....	3.07	4.08	13,120	5,070	8,050	3,000	+ 2,070	+ 5.36	440.54
....	1.35	1.79	5,760	2,220	3,540	3,000	− 780	− 2.02	438.52
....	.71	.94	3,030	1,160	1,770	3,000	− 1,840	− 4.77	433.75
....	.32	.43	1,370	530	840	2,660	− 2,130	− 5.52	428.23
....	.47	.62	2,010	770	1,240	2,260	− 1,490	− 3.86	424.37
....	.21	.28	900	350	550	2,950	− 2,600	− 6.74	417.63
....	.40	.53	1,710	660	1,050	2,450	− 1,790	− 4.63	413.00
....	.35	.47	1,490	580	910	2,590	− 2,010	− 5.20	407.80
....	.75	1.00	3,200	1,240	1,960	1,540	− 300	− .78	407.02
....	.62	.82	2,650	1,020	1,630	1,870	− 850	− 2.20	404.82
....	.54	.72	2,310	890	1,420	2,080	− 1,190	− 3.08	401.74
....	4.62	6.15	19,720	7,620	12,100	0	+ 7,620	+19.72	421.46
....	6.50	8.64	27,800	10,700	17,100	3,000	+ 7,700	+19.94	441.40
....	2.84	3.78	12,130	4,690	7,440	3,000	+ 1,690	+ 4.38	445.78

a No records at Moosehead. Actual run-off figures used.

Column 2 contains the mean monthly run-off at Waterville in second-feet per square mile of drainage area.

Column 3 shows the run-off at Moosehead Lake in second-feet per square mile of drainage area. It is obtained by multiplying column 2 by 1.33, as the run-off per square mile on the area tributary to Moosehead Lake is 1.33 times that on the entire basin above Waterville.

Column 4 gives the discharge in second-feet at Waterville. It is obtained by multiplying the run-off in second-feet per square mile at Waterville (column 2) by 4,270, the area of the drainage basin at Waterville.

Column 5 gives the discharge in second-feet into Moosehead Lake. It is obtained by multiplying the run-off in second-feet per square mile at Moosehead Lake (column 3) by 1,240, the area of the drainage basin of Moosehead Lake.

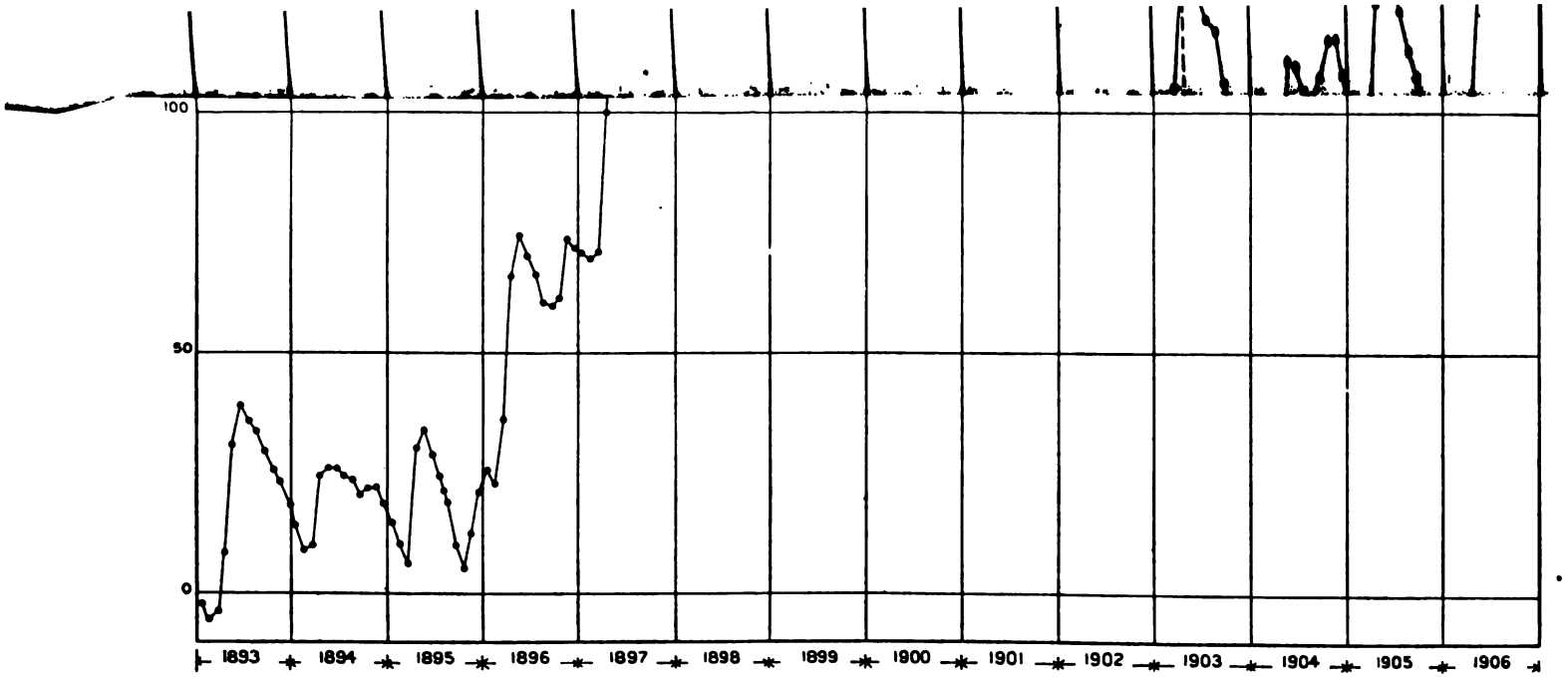
Column 6 gives the discharge in second-feet between Moosehead Lake Outlet and Waterville. It is obtained by subtracting the discharge into Moosehead Lake (column 5) from the discharge at Waterville (column 6.)

Column 7 shows the discharge necessary at Moosehead Lake Outlet to give a flow of 3,500 second-feet at Waterville throughout the year and a flow of 3,000 second-feet at Moosehead Lake Outlet during the log-driving season (May, June, and July). When the discharge between the outlet and Waterville is greater than 3,500 second-feet, it will not be necessary to release any water from the lake; when the flow between the lake and Waterville is less than 3,500 second-feet, the amount necessary is determined by subtracting the flow between Moosehead Lake Outlet and Waterville (column 6) from 3,500; during the log-driving season (May, June, and July) a discharge of 3,000 second-feet is necessary at the outlet.

Column 8 shows the surplus (+) or deficit (—) at Moosehead Lake, a surplus indicating water available for storage and a deficit indicating a withdrawal from Moosehead Lake. The figures are obtained by subtracting the necessary discharge from Moosehead Lake (column 7) from the discharge into Moosehead Lake (column 5).

Column 9 is the equivalent of column 8 expressed in billions of cubic feet.

Column 10 shows the total surplus water, in billions of cubic feet, available for storage during any given month under the given assumptions of minimum flow, etc. The initial value (314.50) represents the total quantity available January 1, 1902, if all the surplus water had been stored since January, 1893. The other values in column 10 are obtained by adding or subtracting respectively the surplus or deficit shown in column 9. The values in this column are used in plotting the "mass curve" (Pl. VI).



STORAGE-MASS CURVE FOR MOOSEHEAD LAKE.

Based on a minimum flow of 3,500 second-feet at Waterville, and a flow of 3,000 second-feet from Moosehead Lake during log-driving period (May, June, and July).

ever, the amount available between any two dates is correctly shown and the maximum ordinate is found as before. Fig. 6 gives the following data:

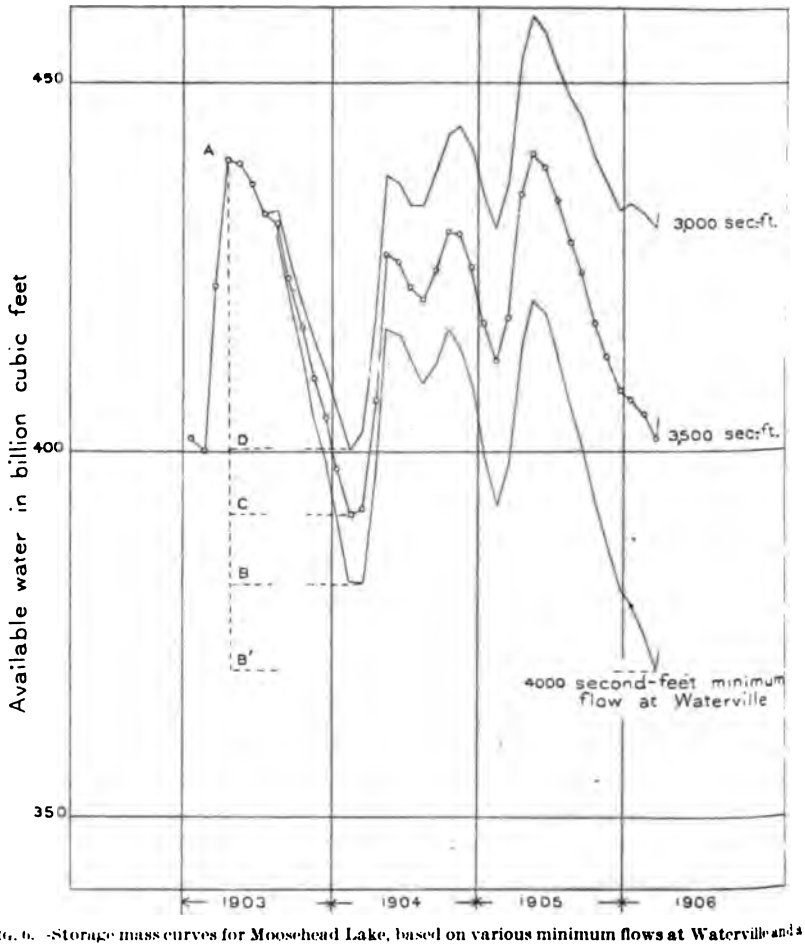
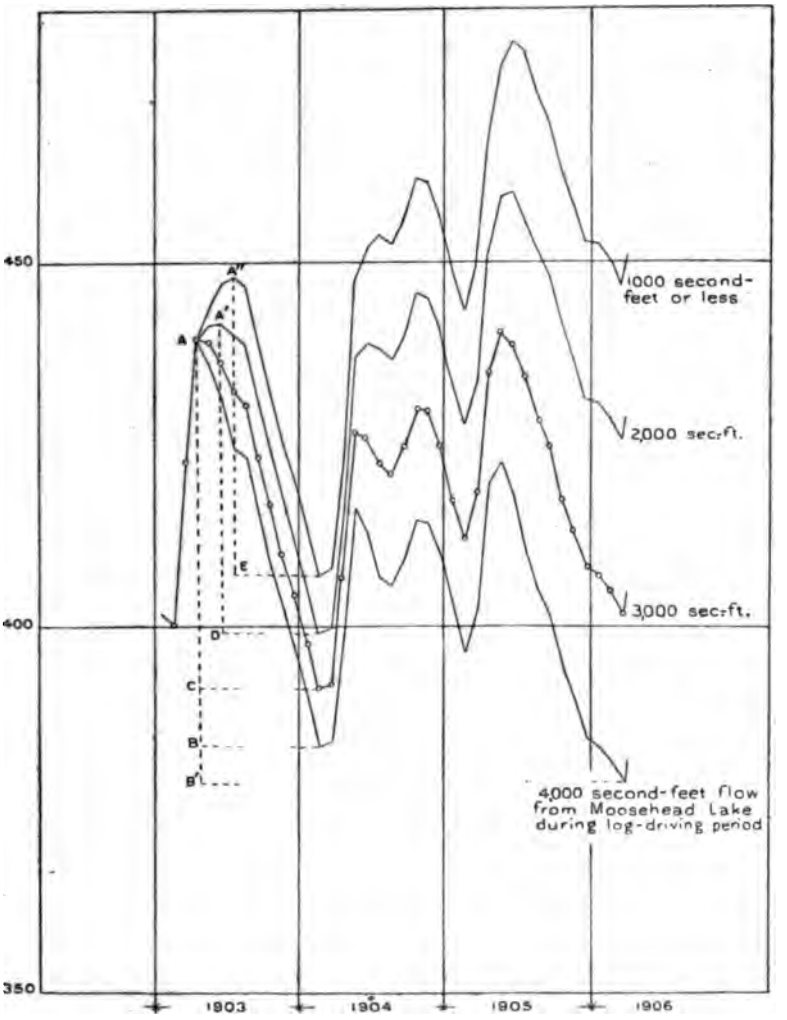


FIG. 6.—Storage mass curves for Moosehead Lake, based on various minimum flows at Waterville and a flow of 3,000 second-feet from Moosehead Lake during log-driving period (May, June, and July).

Storage necessary for flow of 3,000 second-feet from Moosehead Lake during log-driving season and for various minimum flows at Waterville.

Assumed minimum flow at Waterville.	Maximum ordinate in fig. 6.	Storage required.
Second-feet.		*Billion cubic feet.*
3,000	A–D	39.1
3,500	A–C	48.2
4,000	A–B'	69.0

n inspection of fig. 6 indicates that with an assumed minimum of more than about 3,700 second-feet the maximum ordinate is ned by an abscissa drawn through the mass curve at March, 1906, ead of March, 1904 (that is, A–B′ instead of A–B), so that above



—Storage mass curves for Moosehead Lake, based on a minimum flow of 3,500 second-feet at erville and various flows from Moosehead Lake during log-driving period (May, June, and).

minimum flow the required storage will increase much more lly.

ıe effect of modifying the amount of water used for log driving is n by fig. 7. These mass curves start with April, 1903, as those in , but they represent a minimum flow at Waterville of 3,500 sec-

ond-feet, and flows of 1,000, 2,000, 3,000, and 4,000 second-feet from Moosehead Lake during the log-driving season (May, June, and July). From this diagram the following data are obtained:

Storage necessary for 3,500 second-feet minimum flow at Waterville and for various flows during log-driving season.

Assumed quantity for log driving.	Maximum ordinate in fig. 7.	Storage required.
Second-feet.		*Billion cubic feet.*
1,000	A''-E	41.1
2,000	A'-D	42.7
3,000	A -C	48.2
4,000	A -B'	61.0

If 3,750 second-feet or more are considered for log driving the necessary storage period is much increased. If 4,000 instead of 3,000 second-feet are used, the storage period is about three years instead of less than one year, and the amount of storage is represented by A–B' instead of A–B.

The following table is based on the results previously given, as well as on additional mass curves and tables not shown. In all cases the assumptions regarding minimum flow and flow during the log-driving period are such that the shorter period of required storage, ending with February, 1904 (see Pl. VI, figs. 6, and 7), furnishes the maximum ordinate or amount required.

Storage necessary, in billion cubic feet, for various minimum flows at Waterville and at Moosehead Lake Outlet during log-driving season.

Flow at Moosehead Lake Outlet during log-driving season (May, June, and July).	Minimum flow at Waterville.				
	2,000.	2,500.	3,000.	3,500.	3,750.
Second-feet.					
0	16.3	24.1	32.0	41.1	46.1
500	16.3	24.1	32.0	41.1	46.1
1,000	16.3	24.1	32.0	41.1	46.1
1,500	16.3	24.1	32.3	41.4	46.1
2,000	16.3	24.5	33.6	42.7	47.3
2,500	17.6	26.7	35.7	44.8	49.4
3,000	21.6	30.1	39.1	48.2	.....
3,500	24.9	34.0	43.0	52.1	.....
4,000	28.8	37.9	.....	.....	.....

The data in the above table have been plotted in fig. 8. Quantities of water available in billion cubic feet have been plotted as abscissas and minimum flows at Waterville in second-feet as ordinates. The slanting lines indicate the effect of different flows during the log-driving season. They are obtained by connecting points that represent the storage necessary for the various assumed minimum flows at Waterville, where the same flow is used for log driving. It

will be noted that the lines representing a flow of 2,500 second-feet and over for log driving are straight and parallel; those representing 2,000 and 1,500 second-feet are straight and intersect the limiting line, marked 0 to 1,000 second-feet. The effect of different flows for log-driving purposes on required storage is clearly shown by this diagram, and, as would be expected for any minimum flow for log driving below, in general, about 1,500 second-feet, there is little or no change in storage required, because (1) either the quantity required for log driving is less than the amount needed to supply the

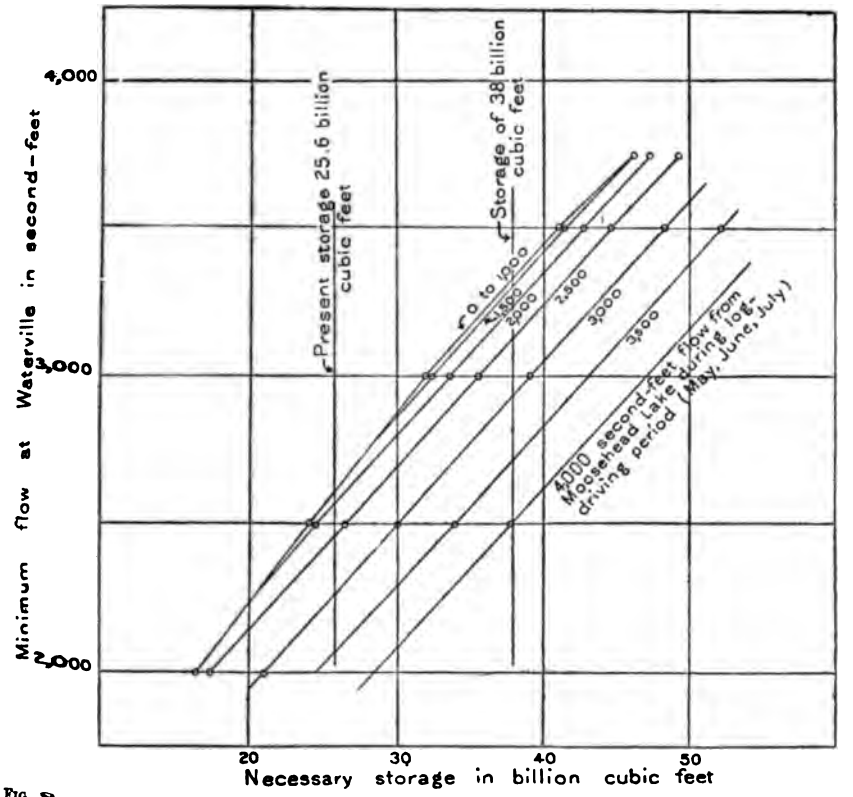


FIG. 8.—Diagram showing storage required in Moosehead Lake for various minimum flows at Waterville and for various quantities used log-driving period (May, June, and July).

deficiency in flow between Moosehead Lake Outlet and Waterville for a given month, as in July, 1903, or (2) there is a surplus flow into Moosehead Lake during the month as regards either the assumed flow for log driving or the quantity required to make up the deficiency in flow between Moosehead Lake Outlet and Waterville, as in May and June, 1903. As these two months are at the beginning of the period when water has to be stored, the effect is simply to raise the point A (fig. 7) and all points after it to February, 1904, inclusive, by the amount of the difference between the assumed minimum flows

for log driving; hence the maximum ordinate remains the same in value.

The running together of the lines representing 0 to 2,000 second-feet (fig. 8) for the lower values of minimum flow at Waterville is occasioned by the relatively high flow into Moosehead Lake in August, 1903, as compared with all later months to February, 1904, inclusive, so that, when less than 1,500 to 2,000 second-feet are used for log driving, a surplus is available at Moosehead Lake in August, the high point A (fig. 7) will occur in August instead of July, and thereafter, for lower values of log-driving flow, the maximum ordinate will remain the same in value.

APPLICATION OF RESULTS OF "MASS CURVE" COMPUTATION.

With the present storage of about 25.6 billion cubic feet in Moosehead Lake and Long and Roach ponds (see p. 138), fig. 8 indicates that when different quantities are used for log driving the minimum flows and the corresponding horsepower at Waterville are as follows:

Minimum flow and corresponding horsepower at Waterville with storage of 25.6 billion cubic feet and various flows for log driving.

Flow at Moosehead Lake Outlet for log-driving (May, June, and July).	Minimum flow at Waterville.	Minimum net horsepower (75 per cent efficiency) at Waterville, corresponding to the 23-foot fall at Hollingsworth & Whitney dam.
Second-feet.	*Second-feet.*	
1,000	2,600	5,100
2,000	2,580	5,020
3,000	2,250	4,410

The mean monthly flow at Waterville has been as low as 921 second-feet (February, 1904), and has been below 2,250 second-feet (the minimum flow with 3,000 second-feet for log driving) many times. (See table of low-water flow at Waterville during 1903–4, p. 120.) Evidently the present storage has not been carefully utilized, and probably the amount of water used for log-driving purposes has exceeded an average of 3,000 second-feet for the three months considered.

With a storage of 38 billion cubic feet on Moosehead and Brassua lakes and Attean and Wood ponds (as given on p. 138) the results shown by fig. 8 are as follows:

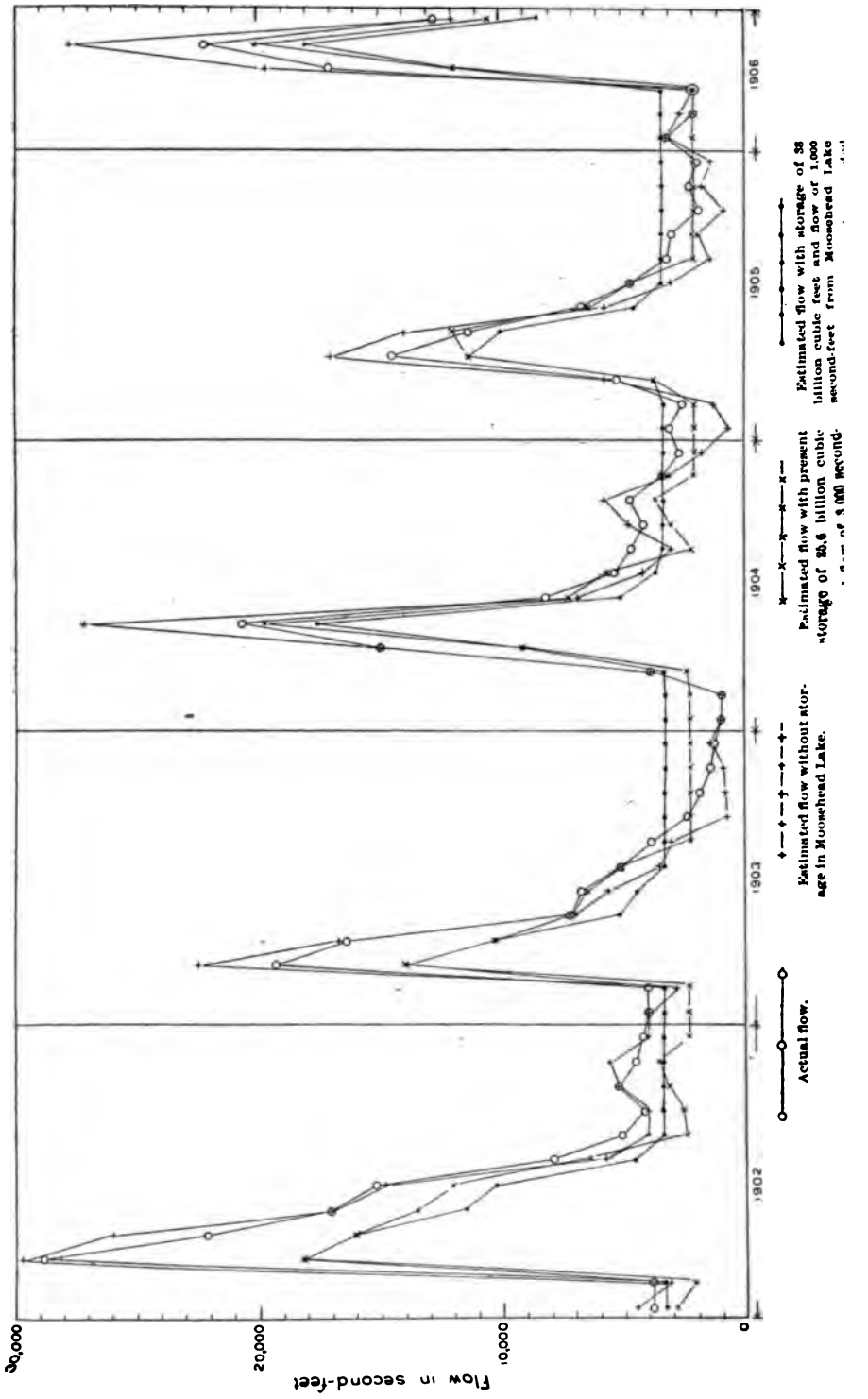
Minimum flow and corresponding horsepower at Waterville with storage of 38 billion cubic feet and various flows for log driving.

Flow at Moosehead Lake Outlet for log driving (May, June, and July).	Minimum flow at Waterville.	Minimum net horsepower (75 per cent efficiency) at Waterville corresponding to the 23-foot fall at Hollingsworth & Whitney dam.
Second-feet.	*Second-feet.*	
1,000	3,340	6,550
2,000	3,240	6,350
3,000	2,940	5,760

In order to show the flow at Waterville during the entire period 1902–1906, if present storage and additional storage capacity had been properly utilized, fig. 9 has been prepared. This shows the following conditions: (1) Actual flow; (2) estimated flow without storage in Moosehead Lake; (3) estimated flow with present storage fully utilized, and a flow of 3,000 second-feet from Moosehead Lake during the log-driving period; and (4) estimated flow with a storage of 38 billion cubic feet and a flow of 1,000 second-feet from Moosehead Lake during the log-driving period.

The advisability of carefully regulating the flow from Moosehead Lake and other storage reservoirs and of limiting the quantity let out for log driving to perhaps 1,000 second-feet is clearly shown by fig. 9 and the preceding tables. With a storage of 38 billion cubic feet, not less than about 6,500 net horsepower would be available at Waterville dam in another such series of dry years, and even with the present storage, 5,100 horsepower should be available at all times.

Other water powers along the river would benefit in about the same proportion. The effect of this regulation on the flow at Moosehead Lake Outlet is indicated by fig. 10, which shows (1) the estimated flow at the outlet of Moosehead Lake without storage, and (2) the estimated flow at the outlet with enough storage to give a flow of 1,000 second-feet during the log-driving months and a minimum flow of 3,340 second-feet at Waterville. As indicated on this figure, there would be usually one or two months in the year when no water would be let out of the lake. These would in general, however, be the early spring months, when the run-off all along the river is large; so that even under this assumption the flow in this part of the river would be fully as great as at present. Moreover, the storage possibilities of Moxie and Pierce ponds and the Dead River Lakes have not been considered in these computations. The proper regulation of storage on these ponds will provide enough water to maintain the required


30,000
20,000
10,000
0
Flow in second-feet
1902
1903
1904
1905
1906
Actual flow.
Estimated flow without storage in Moosehead Lake.
Estimated flow with present storage of 20.6 billion cubic
Estimated flow with storage of 38 billion cubic feet and flow of 1,000 second-feet from Moosehead Lake

imum flow on the lower river, and as a result sufficient water to ride for future power developments above The Forks can be used from Moosehead Lake at all seasons.

CONCLUSIONS.

he foregoing computations and results are not to be considered olute or final. A longer series of dry years or a more severe distri- on of drought would require more storage to provide the minimum , as indicated. But it is reasonably certain that as such a series of year has occurred, it may do so again, and it may be concluded at least the quantity of storage as computed here will be needed. the additional storage that can readily be obtained in Moosehead Brassua lakes and Long, Attean, and Wood ponds can be used to

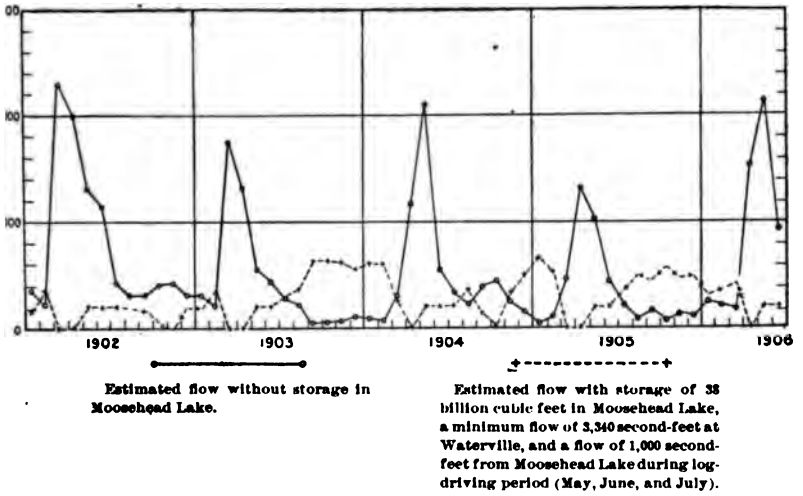

1902
1903
1904
1905
1906
Estimated flow without storage in Moosehead Lake.
Estimated flow with storage of 38 billion cubic feet in Moosehead Lake, a minimum flow of 3,340 second-feet at Waterville, and a flow of 1,000 second-feet from Moosehead Lake during log-driving period (May, June, and July).

FIG. 10.—Diagram showing estimated flow from Moosehead Lake with and without storage.

antage, and it is probable that a storage in addition to that men- ed would be desirable. In order to assist in the regulation of flow he main river, as well as to aid in development of the power on the utary streams, additional storage on the lakes in the Dead River n and on Moxie and Pierce ponds is only second in importance to in and above Moosehead Lake.

wo essentials must be kept in mind, however, or much of the effect dditional storage will be lost:

.) Water must not be wasted in log driving.

:) The flow from Moosehead Lake and other principal reservoirs t be carefully regulated and watched.

ll reservoirs should always be kept as nearly full as possible, and er should be retained as far upstream in the storage system as pos-

sible. The quantity of water let out should not be greater than that needed to furnish the required flow on the river at such points as Waterville and The Forks.

LOG DRIVING AND LUMBERING.

GENERAL STATEMENT.

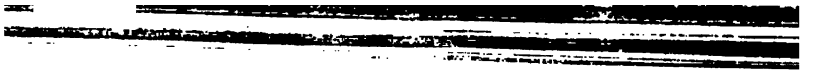
The forests of Maine constitute one of her most important natural resources, and, as previously stated, about one-third of the lumber used for pulp and paper in the State comes down the Kennebec waters. The annual "drive" in the main river usually amounts to about 150,000,000 feet B. M., and a large part of the population in the Kennebec Valley, especially near the headwaters, are engaged in handling the logs, from the stump to the finished product of the mill, or in furnishing the supplies and equipment needed to carry on this industry.

The logs are hauled from the cuttings and piled along the banks of the stream during the winter. On the breaking up of the ice in the spring these piles or landings are rolled into the stream and the logs floated downstream with the current. Boats are used in towing the logs across lakes or where the current is not strong enough to carry them along. On many of the smaller streams there are dams which impound the water, and the head thus obtained is used in sluicing and carrying the logs down to the larger streams. (See Pl. V, *B* (p. 128), for a typical dam of this kind.) After the "drive" is over, the gates are left open and the flow becomes a natural one. These dams are necessary on the smaller streams, as the channels are so obstructed with bowlders and small islands that it requires a large amount of water to force the logs downstream. In a general way the same conditions exist on the larger tributaries and on the main river, although the difficulty in driving is here caused usually by a short stretch of narrow and rough channel or by gravel bars. Pl. VII, *B*, shows a portion of the main river just below Madison, where log jams very frequently occur, and Pl. VII, *A*, shows one of the worst jams in recent years just above the railroad bridge at Madison. About 30,000,000 feet of logs were piled up, filling the river to the bottom and raising the upstream water level several feet.

Since about 1830 the Kennebec Log Driving Company has controlled the drives in the main river. Other similar associations are the Moose River Driving Company and the Dead River Driving Company, and from the reports of these three companies a large part of the following data is compiled.

A. LOG JAM IN KENNEBEC RIVER ABOVE MADISON, ME.

B. KENNEBEC RIVER BELOW MADISON, ME.



TIME OF DRIVING.

The smaller tributary streams are driven just as soon as the ice goes out of them in the spring—usually about the latter part of April. The Moose River drive usually reaches Moosehead Lake in the latter part of May, and at about the same time the Dead River drive enters the Kennebec. Moosehead Lake is clear of ice, usually, at least, by May 10, and from that time until perhaps about August 1, depending on the season, water is let out of Indian Pond (which is used as a regulating basin) for varying periods each day. The times when the rear of the drive has left Moosehead Lake and reached Riverside boom (about 5 miles above Augusta) for the six years 1900 to 1905 are given below:

Dates on which rear of drive left Moosehead Lake and reached Riverside boom.

Year.	Left Moosehead Lake.	Reached Riverside boom.
1900	June 23	August 27.
1901	July 3	August 9.
1902	June 15	August 15.
1903	July 5	September 9.
1904	July 2	September 8.
1905	July 24	August 27.

WATER USED IN DRIVING.

The period during which water is let out of Indian Pond dam lasts usually from about May 1 to August 15, although the most water is used during June and July. No record is kept of the flow at this dam or of the length of time the water runs out, although a man is stationed there to control the flow according to the needs of the drive. An inspection of gage readings at The Forks gaging station shows that the duration of the season during which water is let out for log driving is approximately as follows:

Length of period during which water is released for log driving.

1902 ..... May 10 to August 6.
1903 ..... April 26 to August 23.
1904 ..... May 14 to August 16.
1905 ..... May 1 to September 3.
1906 ..... May 1 to August 10.

An estimate of the flow at Moosehead Lake Outlet during the last three years is presented in the subjoined table, based on (1) the measured flow of Moose and Roach rivers; (2) the evaporation and precipitation on the lake; (3) the change in the lake level during a given month. The flow at The Forks gaging station is also given for comparison.

Estimated monthly discharge, in second-feet, of Kennebec River from Moosehead Lake at The Forks, May to August, 1904–1906.

	May.			June.			July.			August.		
	1904.	1905.	1906.	1904.	1905.	1906.	1904.	1905.	1906.	1904.	1905.	1
Moosehead Lake.....	900	3,000	2,700	4,300	3,900	4,100	2,300	3,000	3,900	2,300	2,000	
The Forks.....	5,060	4,330	7,440	6,510	5,410	5,720	5,650	4,060	4,310	2,970	2,070	

The present amount of water let out at Indian Pond dam dur the log-driving season is apparently about as follows, by mont May, 3,000 second-feet; June, 4,000 second-feet; July, 3,000 seco feet; August, 2,000 second-feet.

QUANTITIES OF LOGS DRIVEN AND COST OF DRIVING.

The following table shows the amount and cost of the four p cipal drives for the six years 1900–1905. Except for the Mo River drive the amount of tax per thousand feet B. M. of logs is given and the amount of logs to which this tax was applied, the la figure taking into account the difference in distance driven, wh varies for the different mills along the river. The full tax is for following distances:

(1) On Kennebec River from The Forks to Riverside boom (ab 5 miles above Augusta), 91 miles.

(2) On Kennebec River from Moosehead Lake Outlet to The Fo 24 miles.

(3) On Dead River from North Branch to The Forks, 43 miles.

It must be kept in mind that these figures cover, in addition to cost of driving itself, the other charges arising in carrying on t work, such as cost of dams, improvement of channel, booms, etc., well as executive charges. As many important improvements h been made during these six years, such other expenses have b heavy, and the unit costs of driving are therefore higher than i longer series of years were considered.

Amount and cost of log driving on Kennebec River and tributaries, 1901–1905.

Year.	Kennebec River from The Forks to Riverside boom.				Kennebec River from Moosehead Lake Ou to the Forks.			
	Amount driven.	Amount taxed.	Total cost.	Tax per M.	Amount driven.	Amount taxed.	Total cost.	T pe
	Feet B. M.	*Feet B. M.*			*Feet B. M.*	*Feet B. M.*		
1900....	147,424,579	136,418,020	$54,567.20	$0.40	83,297,162	83,297,162	$4,997.83	
1901....	136,063,291	125,744,768	50,297.90	.40	91,765,535	78,953,778	11,843.07	
1902....	133,772,610	122,655,300	55,194.85	.45	86,391,882	74,707,784	11,206.15	
1903....	146,413,732	135,098,090	67,549.07	.50	95,763,334	83,078,837	12,461.82	
1904....	163,894,303	150,476,608	51,162.05	.34	112,702,582	99,907,353	9,990.76	
1905....	132,025,401	121,274,346	43,658.76	.36	97,655,501	82,844,976	9,112.96	

Amount and cost of log driving on Kennebec River and tributaries, 1901–1905—Cont'd.

Year.	Dead River.				Moose River.	
	Amount driven.	Amount taxed.	Total cost.	Tax per M.	Amount driven.	Total cost.
	Feet B. M.	*Feet B. M.*			*Feet B. M.*	
1900	47,208,011	40,790,202	$14,276.57	$0.35	30,495,221	$10,379.70
1901	39,730,456	32,862,021	11,501.71	.35	30,699,729	13,151.59
1902	44,215,878	34,705,943	13,882.39	.40	35,403,382	13,3.6.61
1903	45,081,154	33,705,719	13,482.28	.40	41,636,226	18,884.88
1904	38,023,533	31,314,718	10,960.17	.35	45,386,208	17,619.09
1905	25,294,441	22,070,364	9,931.68	.45	41,936,725	18,212.36

From the above table we can obtain the cost of driving per mile-thousand, considering the amounts taxed and the distances as previously given, and approximately the cost per ton-mile, considering 1,000 feet B. M. to weigh 3,500 pounds. For Moose River the distance given is computed and is an average one from Moosehead Lake, the various amounts and distances driven being taken into consideration.

Cost of log driving on Kennebec River and tributaries, 1901–1905.

Drive.	Distance.	Average tax per M.	Cost of driving.	
			Per mile-thousand.	Per ton-mile.
	Miles.			
Kennebec River from The Forks to Riverside boom	91	$0.41	$0.0045	$0.0026
Kennebec River from Moosehead Lake to The Forks	24	.12	.0050	.0028
Dead River	43	.38	.0089	.0051
Moose River	17	.....	.024	.014
Moosehead Lake (Moose River to lake outlet, logs towed by boat)	9	[a].12	.013	.0074

[a] Contract price for ten years.

It appears that the cost of log driving per ton-mile varies from about one-fourth to 1½ cents, depending on the distance driven and difficulties experienced. The average freight rate in the United States at present is about 0.8 cent per ton-mile, and for the New England group of railroads 1.20 cents per ton-mile. Under exceptionally favorable circumstances rates as low as 0.2 cent per ton-mile have been granted for coal transportation from the coal fields to tide water. Rates during 1906 for log transportation on the new Somerset Railway extension are of interest in this connection, and are given below through the courtesy of Hon. William T. Haines:

Cost of transportation of logs by rail.

Logs shipped from Moscow to—	Average distance.	Charge per thousand feet B. M.	Cost of transportation.	
			Per mile-thousand.	Per ton-mile.
	Miles.			
Bingham	12	$1.75	$0.146	$0.080
Solon	20	2.00	.100	.057
North Anson	29	[a]1.50	.052	.030

[a] This price involves reshipment as manufactured lumber on Somerset Railway.

The average freight rate on the Somerset Railway for 1904 was 2.7 cents per ton-mile.

The cost of water transportation of logs is thus seen to be very low and for many years the bulk of the logs will probably be river driven where it can be done, although there is unquestionably much timber that will have to be taken out by rail.

IMPROVEMENTS IN LOG-DRIVING FACILITIES.

During the five years 1901–1905 the Kennebec Log Driving Company has spent on the Kennebec the following amounts for items relating especially to channel improvements. About one-half of the cost of main dams has been paid by the Kennebec Water Power Company.

Amounts spent for improving channel of Kennebec River, 1901–1905.

Removing gravel beds for channel	$1,100
Blasting out rock for channel	2,200
Building and repairing piers	4,700
Building and repairing side dams, or "bumpers"	1,200
Building and repairing main dams	65,000

In 1896 the late Sumner Hollingsworth, engineer for the Hollingsworth & Whitney Company, reported to the Kennebec Water Power Company on the general subject of channel improvement of the upper Kennebec, advocating the beginning of such work, so that eventually the drive in this part of the river could be made with a flow of 1,000 second-feet from Moosehead Lake. Some of the worst places have been improved, but much remains to be done in removing bowlders and building log bumpers before the drive can be made on so small a flow. On Dead River from the Dead River dam to The Forks very large quantities of water are required in driving, as the bed of the river is extremely rough. Much work could be done here to advantage in removing bowlders, etc.

Fred T. Dow, engineer for the Kennebec Water Power Company, in a report made during 1906, advocates a systematic plan of improvement of both the Kennebec River and Dead River channels, to be completed during the next eight or ten years, and calls especial attention to the necessity of checking freshet flow as far as possible by storage reservoirs to prevent the washing of high banks and the subsequent formation of new gravel bars.

QUALITY OF KENNEBEC RIVER WATER.

By GEORGE C. WHIPPLE.

INTRODUCTION.

1903 and 1904 appraisals were made of the water supplies of ities of Waterville and Augusta, Me., in connection with a fer of those works from private companies to so-called "water cts," which virtually stood for the municipalities. In these aisals the quality of the water supplied by the private compa- played an important part, especially as both cities had been d by severe epidemics of typhoid fever during the winter of -3. Waterville was at that time supplied by the Maine Water pany with water from Messalonskee, but the company had also ight to use water from the Kennebec. Augusta was supplied Kennebec River water by the Augusta Water Company.

order to obtain sufficient evidence as to the quality of these r supplies, many samples of water were collected from Messa- ee and Kennebec rivers in the vicinity of these two cities and from a number of the tributary streams and neighboring ponds. nnection with the typhoid epidemics, numerous samples of well r were analyzed, both in Waterville and Augusta, and in con- on with the search for new sources of supply, which have since introduced at both places, analyses of water from various local and ponds were made. This body of analytical data, taken her, serves to give a fairly accurate picture of the quality of Kennebec River water in its middle portion, as well as that me of the lakes and streams of its drainage basin. Moreover, Kennebec itself, lying in the central part of the State and flow- as do most of the Maine rivers, in a general southerly or south- rly direction from the Canadian boundary to the Atlantic Ocean, regard to the general quality of its water typical of the large s of the State.

e analytical records extend over a period of but one year, dur- which the general stage of the water was below the average. fact should be remembered in considering the results. The ge color of the water, for instance, as shown by the figure , is probably somewhat lower than it would be under ordinary

conditions, and this is also true, though in a less degree, of the turbidity. The hardness of the water, on the contrary, as here given is probably above the general average for an ordinary year.

The general topographic and geologic characters of the Kennebec River drainage area are discussed elsewhere in this paper (pp. 4–9), but in connection with the results of the analyses it is well to recall that the basin is densely wooded in its upper portion and that its lower portion is more open and given to cultivation. Taken as a whole, the percentage of cultivated land on the watershed is very small. The rock formations are largely granitic and there are no deposits of limestone. The soil is mainly glacial drift. There are comparatively few deposits of clay, although these are not entirely absent. An important feature of the drainage area is the large percentage of water surface. An inspection of the map will show that it is essentially a lake country. Most of the population is concentrated near the river banks, especially at points where there are good water powers. Exclusive of the river towns, the population of the basin is extremely small.

The river is used very largely for logging, and during the driving period logs pass in an almost continuous mass from Moosehead Lake to Gardiner. There are numerous manufacturing establishments at the centers of population. Most of these are pulp and paper mills, sawmills, and cotton mills. The sewage from the cities, the manufacturing wastes from these establishments, and the log driving on the river constitute the three principal sources of pollution of the water. Below Augusta the river is a tidal estuary, and the effect of the sea water is at times very noticeable. The water of the river is used by several of the towns and cities along its banks, and great quantities of ice are cut in the lower reaches and shipped to places farther south. The quality of the water is, therefore, a matter of very great importance to many people.

In studying the quality of the water of this river it will be convenient to look first at its normal or natural quality, especially in regard to such physical characteristics as turbidity, color, taste, and odor, and afterwards to take up the sources of pollution and their effects.

WATER EXAMINATIONS.

All the analyses were made substantially in accord with the standard methods of water analysis adopted by the American Public Health Association.

TURBIDITY.

The turbidity of the water of Kennebec River at Waterville and Augusta is shown in the tables on pages 172–177. From these it will be seen that the turbidity has varied at different times from 2 to 60 on

silica scale. During the early part of 1903 very few observations
e made, and there is good reason to believe that in the spring of
t year the turbidity considerably exceeded the maximum amount
erved, probably reaching 200 or 300 for short periods. During
spring of 1904, when the river was at an unusually low stage for
t season of the year, the maximum turbidity did not exceed 15.
average turbidity for the year was 9. From the middle of
gust, 1903, until the middle of March, 1904, daily observations
e made at Augusta, and the results for that period are therefore
ch more reliable than the scattering figures obtained during the
t half of 1903. The average turbidity at Augusta for the period
ed was 6. During August, September, and a part of October it
lom exceeded 5. In the latter part of December, however, it
eased and for over a week remained higher than 15. After the
r froze over in the winter the turbidity again fell, and the water
ained comparatively clear. At this time a large proportion of
suspended matter found was of organic origin; some of it evidently
sisted of fragments of wood pulp discharged from the pulp and
er mills. This was indicated by the stringy appearance of the
pended matter when allowed to settle quietly in a bottle; but a
e positive test was given with a microscope, which showed un-
takably the presence of fragments of wood fiber.

he turbidity of the water in Messalonskee Stream, which flows
the Kennebec just below Waterville, was at times greater than
t of the Kennebec itself. This is shown by the figures given in
table on pages 177–181. After rains the turbidity of this water
eases very rapidly, even in a few hours. The Messalonskee drains
ain of lakes, and its natural water would be very clear were it not
a small tributary which cuts through a number of clay deposits
which becomes very turbid after a heavy rain. This brook also
ives the surface wash from numerous farms, which adds to its
idity.

esides the clay and the organic sediment already mentioned, the
ended matter of the Kennebec after heavy rains consists of river
which has a comparatively high coefficient of fineness and settles
dly as soon as the velocity of the water has decreased. In certain
hes of the river, therefore, deposits of river silt have been formed.
imentation has been favored by the numerous dams along the
am, which cause long stretches of backwater. Between Water-
and Augusta the mud deposits are extensive, and because of the
e amount of sewage discharged at Waterville they become foul
ill smelling at times of low water. Without doubt this settling
he river sediment in the long stretch of backwater behind the
gusta dam had an important effect on the quality of the water

supply of Augusta when it was taken from the river. These deposits are referred to again in connection with the subject of pollution (p. 188).

COLOR.

Like that of most of the rivers in Maine, the Kennebec River water has a deeply stained appearance at certain seasons of the year. The variations in color are shown in the tables on pages 172–177. From these tables it will be seen that the color of the river water varied during the period covered by the observations from 15 to 108, and that the average color of the water was 37. The maximum color occurred in June. From that time until the latter part of the year the color steadily decreased. In December and January an increase in color accompanied the rise of turbidity, but the maximum did not exceed 43. During the winter when the streams were frozen the color dropped rapidly and remained between 20 and 30 for several months.

The figures given in the tables all refer to the apparent color of the water, but the removal of the suspended matter by filtering through coarse filter paper did not ordinarily reduce the color by more than 10 or 15 per cent. Filtration through a Berkfeld filter, however, removed approximately one-third of the color, indicating that a considerable part of it was due to organic matter in an extremely fine state of division. A second filtration through a Berkfeld filter did not show a subsequent removal of color to any extent. It may be said, therefore, that approximately two-thirds of the color was due to dissolved organic matter and that the balance was due to organic matter in a colloidal or finely divided state of suspension.

The source of the color is to be sought chiefly in the swampy areas lying in the upper portions of the basin, where leaves, roots, twigs, the bark of fallen logs, and vegetable mold are continually being leached by the standing water. After a period of storage in these swampy areas, these leachings are washed into the streams at times of rain and add their quota to the color of the water. It will be noticed that the maximum color occurs in the spring, after the snow and ice have disappeared and the swamps have discharged their contents into the rivers. As the brooks dry up in summer, the amount of coloring matter contributed by them decreases, and the color of the river water falls. There is a secondary maximum in the fall or early winter due to the autumnal rains; but during the fall of 1903, which was exceptionally dry, this maximum was inconspicuous, although there was a slight increase in color early in September. During the winter the river and small tributary streams freeze, and the amount of water which the latter contribute decreases very greatly and sometimes ceases entirely, the streams meantime being fed largely by ground water. The result of this is that in the winter the color of the water reaches its lowest point.

It has been thought by many that some of the color shown by the water of the river in early summer may be attributed to the logs which are floated down the river, the bark obtaining its initial extraction during the early months of the year. In order to determine to what extent this was a factor, some experiments were made in a laboratory temporarily installed at Waterville by Dr. Ernest C. Levy. Samples of bark from logs recently cut were put into jars with 1,500 c. c. of colorless spring water. These were allowed to stand and the colors were read at the end of five days and again at the end of twenty-five days. In each sample the bark was attached to the wood. The following figures show the results obtained:

Effect of bark on color of water.

Kind of wood.	Bark surface (square centimeter).	Color (parts per million).					
		After 5 days.	After 25 days.	Per liter for each 100 square centimeter of bark surface.		Per gallon of water per square foot of bark.	
				5 days.	25 days.	5 days.	25 days.
Fir	60	40	40	102	102	247	247
White pine	56	70	110	188	236	455	578
Spruce	78	90	160	172	308	416	753
Juniper	56	90	200	242	536	591	1,320
Norway pine	60	110	240	250	600	605	1,465
Hemlock	66	140	260	319	667	772	1,630
Cedar	65	140	300	239	690	580	1,685
Average	63	83	187	216	448	524	1,098

From the above figures it will be seen that cedar and hemlock are the most active of the fir trees of Maine in giving color to water. In round numbers, it may be said that 1 square foot of bark will increase the color of 1,100 gallons of water by one unit of the ordinary scale of measurement after an exposure of one month. The ordinary log of the Kennebec River drives has about 70 square feet of bark surface. Therefore one log would increase the color of 77,000 gallons of water one unit after standing in it for about a month. Further calculations show that 1,000 feet B. M. of lumber will increase the color of 616,000 gallons of water about one unit during the same time. Inasmuch as the average flow of Kennebec River is about 3,500,000,000 gallons per day, it would require 50,000 logs a day to increase the color of the river water by one point. This is four or five times the number of logs floated per day from April to July. Therefore it will be seen that this factor is entirely negligible in the consideration of the color of the Kennebec water. If, however, the logs stand in the water of swamps for more than this length of time, there is a chance that they might give a slight color to the river water.

ODOR.

The water of the Kennebec River has at all times a swampy or peaty odor and taste, usually described by the term "vegetable;" but during the spring, when the color of the water is high, the odor becomes more distinct. It is due in great measure to the same organic compounds which give to the water its color, and represents the effect of the natural leaching of the decaying organic matter in the various swamps scattered over the drainage area.

In addition to this natural swampy taste, the water of the river at certain points below the centers of industry has at times a very marked taste, due to the discharge of sewage and manufacturing wastes into the stream. This is further discussed under the heading "Pollution" (pp. 194–195).

During the period covered by the analyses no odors due to algæ or other microscopic organisms were observed.

RESULTS OF EXAMINATIONS.

Results of examination of Kennebec River water above Waterville.

Date.	Turbidity.	Color.	Bacteria per cubic centimeter.	Bacillus coli.[a]		
				In 0.1 c. c.	In 1 c. c.	In 10 c. c.
1903.	*Parts per million.*	*Parts per million.*				
January 19	2	37	400	.....	.....	.....
February 16	.....	.....	2,750	−	+	+
February 27	0	34	3,500	+	+	+
March 12	60	50	4,400	+	+	+
March 18[b]	.....	.....	2,350	−	+	+
March 21	.....	.....	1,800	−	+	+
March 28	.....	.....	605	−	+	+
April 4	15	45	635	+	+	+
April 14	18	40	660	−	+	+
April 18	10	40	470	−	−	−
April 28	10	28	240	−	+	+
May 12	6	38	1,100	+	+	+
May 23	5	36	640	−	+	+
June 3	8	36	1,500	−	+	+
June 14	48	100	15,000	+	+	+
June 15	16	108	.....	.....	.....	.....
June 16	12	100	6,800	−	+	+
June 17	10	96	.....	.....	.....	.....
June 23	5	56	1,900	+	+	+
July 14	20	40	110	−	−	−
August 5	10	50	.....	−	+	+
August 17	3	38	600	−	+	+
August 20	4	36	250	−	−	−
August 22	3	38	360	+	+	+
August 25	2	42	.....	−	−	+
August 27	2	58	220	−	+	+
August 29	2	50	145	−	−	+
September 1	2	42	900	−	+	+
September 14	3	38	185	+	+	+
September 15	.....	.....	320	+	+	+
September 18	4	38	300	−	−	+
September 22	7	38	380	−	+	+
September 26	.....	.....	220	−	+	+
September 30	.....	.....	185	−	+	+
Average	11	51	1,631	.....	.....	.....
Per cent giving positive test	.....	.....	.....	30	81	96

[a] Plus sign indicates the presence and minus sign the absence of this organism.
[b] This sample was taken at Fairfield.

ts of examination of Kennebec River water at intake of Augusta waterworks.

AUGUST, 1903.

r.	Turbidity.	Color.	Odor.[a]	Bacteria per cubic centimeter.	Bacillus coli.		
					In 0.01 c. c.	In 0.1 c. c.	In 1 c. c.	In 10 c. c.
	Parts per million.	*Parts per million.*						
.....	2	29	1v	280	.....	.....	.....	.....
.....	5	32	.....	260	.....	−	−	+
.....	3	42	.....	305	.....	+	+	+
.....	2	38	2v 3w	475	.....	−	−	−
.....	2	38	2v 3w	225	.....	+	+	+
.....	2	37	2v 3w	290	.....	−	−	−
.....	3	45	2v 3w	360	.....	−	−	+
ge.....	3	36	2v 3w	313	.....	.....	.....	.....
ing posi-								
.....					.....	33	33	66

SEPTEMBER, 1903.

.....	4	36	2v 3w	740	.....	−	−	−
.....	3	44	2v 3w	490	.....	−	+	+
.....	3	42	2v 3w	210	.....	−	+	+
.....	3	43	2v 3w	405	.....	−	+	+
.....	4	45	3v 3w	390	.....	−	−	−
.....	3	41	2v 3w	300	.....	+	+	+
.....	3	42	2v 3w	230	.....	+	+	+
.....	4	39	2v 3w	260	.....	+	+	+
.....	3	42	2v 3w	365	.....	−	−	+
.....	3	42	2v 3w	380	.....	−	+	+
.....	3	37	2v 3w	260	.....	−	+	+
.....	3	39	2v 3w	235	−	−	+	.....
.....	3	32	2v 3w	410	−	−	+	.....
.....	4	33	2v 3w	610	+	+	+	.....
.....	2	33	2v 3w	235	−	−	−	.....
.....	3	33	1v 3w	315	−	+	+	.....
.....	4	33	1v 3w	420	−	−	+	.....
.....	3	33	1v 3w	345	−	−	−	.....
.....	5	34	1v 3w	540	−	−	+	.....
.....	3	34	1v 3w	585	−	+	+	.....
.....	4	34	1v 3w	615	−	−	+	.....
.....	3	32	1v 3w	370	−	−	+	.....
.....	3	32	1v 3w	500	−	+	+	.....
.....	2	34	1v 3w	830	−	+	+	.....
.....	3	33	1v 3w	605	−	−	+	.....
.....	3	33	1v 3w	735	−	+	+	.....
.....	5	29	2v 3v	720	−	+	+	.....
.....	5	32	2v 3w	480	−	−	−	.....
.....	2	32	2v 3w	405	−	−	+	.....
.....	3	32	2v 3w	455	−	−	+	.....
ge.....	3	36	2v 3w	451	.....	.....	.....	.....
ing posi-								
.....					5	33	80	82

table odor; w=woody odor (due to paper-mill wastes); g=grassy odor. The intensity is indicated by the following scale: 1, Very faint—an odor that would not ordinarily be the average consumer, but that could be detected in the laboratory by an experienced faint—an odor that the consumer might detect if his attention were called to it, but that otherwise attract attention; 3, distinct—an odor that would be readily detected and that the water to be regarded with disfavor; 4, decided—an odor that would force itself on m and might make the water unpalatable; 5, very strong—an odor of such intensity that would be absolutely unfit to drink, a term to be used only in extreme cases.
n indicates the presence and minus sign the absence of the organism.

Results of examination of Kennebec River water at intake of Augusta waterworks—Co

OCTOBER, 1903.

Day.	Turbidity.	Color.	Odor.[a]	Bacteria per cubic centimeter.	Bacillus coli.			
					In 0.01 c. c.	In 0.1 c. c.	In 1 c. c.	In 1
	Parts per million.	*Parts per million.*						
2	3	34	2v 3w	330	—	—	+	.....
3	2	33	1v 2w	290	—	+	+	.....
4	5	33	.....	315	—	—	—	.....
5	6	34	.....	530	—	—	—	.....
6	6	28	1v 2w	295	—	—	—	.....
7	4	32	1v 2w	415	—	—	—	.....
8	6	28	1v 2w	410	—	+	+	.....
9	5	28	1v 2w	375	—	—	+	.....
10	5	31	2v 1w	380	—	—	+	.....
11	5	33	2v 1w	340	—	—	+	.....
12	4	30	2v 1w	450	—	+	+	.....
13	6	30	2v 1w	330	—	+	+	.....
14	7	32	2v 1w	345	—	+	+	.....
15	5	31	2v 1w	420	—	—	+	.....
16	8	31	2v 1w	980	—	—	+	.....
17	7	31	2v 1w	585	—	—	+	.....
18	4	29	2v 1w	945	—	—	+	.....
19	6	30	2v 1w	630	—	+	+	.....
20	6	30	2v 1w	330	—	—	+	.....
21	6	30	2v 1w	410	—	—	+	.....
22	6	29	2v 1w	760	—	+	+	.....
23	7	28	2v 1w	1,040	—	+	+	.....
24	5	28	2v 1w	685	—	—	+	.....
25	4	29	2v 1w	535	—	—	—	.....
26	5	30	2v 1w	725	—	—	—	.....
27	6	27	2v 1w	830	—	—	+	.....
28	5	28	2v 1w	830	—	—	+	.....
29	5	30	2v 1w	540	—	+	+	.....
30	5	30	2v 1w	410	—	—	+	.....
31	4	30	2v 1w	575	—	—	+	.....
Average	5	30	2v 1w	532	.....	.....	.....	.....
Per cent giving positive test	.....	.....	.....	.....	—	33	80	.....

NOVEMBER, 1903.

1	5	30	2v 1w	725	—	—	—	.....
2	5	30	2v 1w	720	—	—	—	.....
3	5	30	2v 1w	700	—	—	—	.....
4	5	29	2v 1w	600	—	—	—	.....
5	4	29	2v 1w	475	—	+	+	.....
6	6	29	2v 1w	385	—	—	—	.....
7	10	33	2v 1w	570	—	—	+	.....
8	10	32	2v 1w	520	.....	+	+	+
9	10	31	2v 1w	580	.....	—	+	+
10	12	31	2v 2w	625	.....	—	+	+
11	10	32	2v 2w	590	.....	—	—	+
12	9	33	2v 2w	655	.....	—	+	+
13	5	31	2v 2w	695	.....	—	—	+
14	6	32	2v 2w	500	.....	+	+	+
15	8	33	2v 2w	350	.....	—	—	+
16	8	32	2v 2w	830	.....	—	+	+
17	6	32	2v 2w	175	.....	—	—	+
18	5	30	2v 2w	750	.....	—	+	+
19	6	33	2v 2w	650	.....	+	+	+
20	4	30	2v 2w	750	.....	—	—	+
21	5	33	2v 2w	830	.....	+	+	+
22	5	33	2v 2w	595	.....	—	+	+
24	.....	.....	.....	860	.....	—	—	+
25	.....	.....	.....	845	.....	—	+	+
26	.....	.....	.....	(a)	.....	.....	.....	.....
27	.....	.....	.....	(a)	.....	.....	.....	.....
28	6	30	2v 2w	(a)	.....	—	—	+
29	7	32	.....	(a)	.....	+	+	+
30	4	33	.....	.....	.....	—	+	+
Average	7	31	2v 2w	624	—	22	56	
Per cent giving positive test	.....	.....	.....	.....	.....	.....	.....	.....

[a] Plates liquefied because of poor lot of gelatin.

examination of Kennebec River water at intake of Augusta waterworks—Cont'd.

DECEMBER, 1903.

y.	Turbidity.	Color.	Odor.a	Bacteria per cubic centimeter.	Bacillus coli.			
					In 0.01 c. c.	In 0.1 c. c.	In 1 c. c.	In 10 c. c.
	Parts per million.	*Parts per million.*						
.....	5	32	2v 2w	.....	.....	−	+	+
.....	3	33	2v 2w	.....	.....	+	+	+
.....	6	33	2v 2w	2,155	.....	−	+	+
.....	6	33	2v 2w	2,000	.....	−	+	+
.....	3	31	2v 2w	2,200	.....	+	+	+
.....	3	32	2v 2w	6,345	.....	+	+	+
.....	7	30	2v 2w	3,330	.....	−	+	+
.....	4	31	2v 2w	4,450	.....	−	−	−
.....	5	33	2v 2w	4,550	.....	+	+	+
.....	3	33	2v 2w	.....	.....	−	−	−
.....	6	33	2v 2w	2,200	.....	−	−	−
.....	10	32	2v 2w	4,400	.....	−	−	−
.....	7	15	2v 2w	5,500	.....	+	+	+
.....	5	32	2v 2w	5,250	.....	−	−	−
.....	5	32	2v 2w	3,150	.....	+	+	+
.....	8	30	2v 2w	5,600	.....	−	−	−
.....	6	33	2v 2w	5,700	.....	+	+	+
.....	6	28	2v 2w	5,500	.....	−	−	−
.....	10	28	2v 2w	5,500	.....	−	+	+
.....	12	28	2v 2w	4,500	.....	+	+	+
.....	10	28	2v 2w	3,900	.....	+	+	+
.....	20	40	2v 2w	5,900	.....	+	+	+
.....	25	35	2v 2g 2w	1,180	.....	−	+	+
.....	30	33	2v 2g 2w	7,750	.....	+	+	+
.....	20	34	2v 2g 2w	11,900	.....	+	+	+
.....	25	36	2v 2w	21,500	.....	−	+	+
.....	22	36	2v 2w	6,250	.....	+	+	+
.....	25	36	2v 2w	6,500	.....	+	+	+
.....	25	37	2v 2w	11,600	.....	+	+	+
.....	15	34	2v 2w	35,700	.....	+	+	+
.....	15	34	2v 2w	37,450	.....	+	+	+
age.....	12	32	2v 2w	7,927	.....	.....	.....	.....
ring posi-								
.....	.....	.....	.....	.....	.....	45	78	78

JANUARY, 1904.

.....	12	40	2v 2g	283,500	.....	+	+	+
.....	12	41	2v 2g	1,555	.....	−	−	−
.....	.....	.....	.....	11,700	.....	−	−	−
.....	10	42	2v 2g	43,500	.....	−	+	+
.....	8	42	2v 2g	51,000	.....	+	+	+
.....	10	42	2v 2g	39,500	.....	+	+	+
.....	6	43	2v 2g	30,500	.....	+	+	+
.....	5	42	2v 2g	40,000	.....	+	+	+
.....	8	37	2v 2g	41,000	.....	+	+	+
.....	.....	.....	.....	40,000	.....	−	+	+
.....	5	40	2v 2g	56,500	.....	−	−	+
.....	5	38	2v 2g	38,000	.....	−	−	−
.....	5	37	2v 2g	20,500	.....	−	−	−
.....	5	36	2v 2g	37,000	.....	+	+	+
.....	3	38	2v 2w	23,000	.....	+	+	+
.....	10	33	2v 2g	9,000	.....	+	+	+
.....	3	32	2v 2g	19,500	.....	−	+	+
.....	3	33	2v 2g	10,000	.....	+	+	+
.....	2	32	2v 2g	14,500	.....	+	+	+
.....	3	28	2v 2g	12,000	.....	+	+	+
.....	3	27	2v 2g	10,000	.....	−	+	+
.....	3	27	2v 2g	9,000	.....	−	−	−
.....	2	28	2v 2g	21,500	.....	+	+	+
.....	3	28	2v 2w	15,000	.....	−	−	−
.....	2	27	2v 2w	22,000	.....	−	−	−
.....	2	26	2v 2w	20,000	.....	−	+	+
.....	4	23	2v 2w	14,000	.....	−	+	+
.....	3	24	2v 2w	18,500	.....	+	+	+
.....	4	27	2v 2w	18,500	.....	+	+	+
.....	2	27	2v 2w	24,500	.....	−	−	−
.....	3	28	2v 2w	18,000	.....	−	+	+
age.....	5	30	2v 2g	32,750	.....	.....	.....	.....
ring posi-								
.....	.....	.....	.....	.....	.....	48	71	78

Results of examination of Kennebec River water at intake of Augusta waterworks—Cont'd.

FEBRUARY, 1904.[a]

Day.	Turbidity.	Color.	Odor.[a]	Bacteria per cubic centimeter.	Bacillus coli.			
					In 0.01 c. c.	In 0.1 c. c.	In 1 c. c.	In 10 c. c.
	Parts per million.	*Parts per million.*						
1	4	21	2v 2w	17,500	.....	+	+	+
2	8	22	2v 2w	24,500	.....	−	−	−
3	5	22	2v 2w	29,000	.....	−	−	−
4	6	18	2v 2w	25,500	.....	+	+	+
5	4	21	2v 2w	28,500	.....	−	−	−
6	4	22	2v 2w	28,000	.....	−	−	−
7	4	22	2v 2w	20,000	.....	−	−	−
10	4	22	2v 2w	20,500	.....	−	+	+
17	7	22	2v 2w	19,000	.....	−	−	+
22	4	26	2v 2w	21,000	.....	+	+	+
23	2	26	2v 2w	23,000	.....	+	+	+
24	2	22	2v 2w	29,000	.....	.....	.....	.....
25	6	27	2v 2w	21,500	.....	−	−	−
26	3	23	2v 2w	24,000	.....	−	−	−
27	5	28	2v 2w	25,000	.....	−	−	−
28	5	25	2v 2w	30,000	.....	+	+	+
Average	4	23	2v 2w	24,466	.....	.....	.....	.....
Per cent giving positive test					.....	33	40	6

MARCH, 1904.

1	3	20	2v 2w	24,500	.....	−	−	−
2	2	27	2v 2w	20,500	.....	−	+	+
3	10	22	2v 2w	20,000	.....	+	+	+
4	.....	.....	.....	26,000	.....	−	−	−
5	.....	.....	.....	22,000	.....	.....	−	−
6	3	29	3v 3w	20,500	.....	−	−	−
7	8	27	2v 2w	20,000	.....	+	+	+
8	4	22	2v 2w	(b)	.....	−	+	+
9	15	25	2v 2w	(b)	.....	+	+	+
10	15	25	2v 2w	(b)	.....	+	+	+
11	15	27	2v 2w	(b)	.....	−	−	−
12	12	25	2v 2w	20,000	.....	+	+	+
13	12	25	2v 2w	(b)	.....	−	−	−
14	15	27	2v 2w	24,000	.....	+	+	+
15	12	31	2v 2w	21,500	.....	−	−	−
16	12	32	2v 2w	19,500	.....	−	−	−
17	8	35	2v 2w	8,000	.....	+	+	+
18	10	31	2v 2w	22,000	.....	+	+	+
Average	10	27	2v 2w	20,654	.....	.....	.....	.....
Per cent giving positive test					.....	44	55	5

[a] The records during this month were interrupted by the illness of the collector.
[b] Plates liquefied.

mmary, by months, of results of examination of Kennebec River water above Waterville and at Augusta.

ABOVE WATERVILLE.

Month.	Number of samples.	Turbidity (parts per million).			Color (parts per million).			Bacteria per cubic centimeter (parts per million).			Average alkalinity (parts per million).
		Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.	Minimum.	Maximum.	Average.	
1903.											
ruary	2							2,750	3,500	3,125	
ch	4	60	60	60	50	50	50	605	4,400	2,284	8
il	4	10	18	13	28	45	38	240	660	500	9
	2	5	6	6	36	38	37	640	1,100	870	7
e	6	5	48	17	56	108	83	1,500	15,000	6,300	10
	1			20			40			110	
ust	7	2	10	4	36	58	44	145	600	315	14
tember	6	2	7	4	38	42	39	185	900	252	13

AUGUSTA.

1903.											
gust	7	2	5	3	29	45	36	225	475	313	14
tember	30	2	5	3	32	45	36	230	830	451	15
ober	30	2	8	5	27	34	30	290	1,040	532	13
vember	25	4	12	7	29	33	31	175	860	624	15
ember	31	3	30	12	15	40	32	1,180	37,450	7,927	17
1904.											
uary	29	2	12	5	23	42	30	1,555	283,500	32,750	18
ruary	16	2	8	4	18	28	23	17,500	30,000	24,466	16
rch	16	2	15	10	20	35	27	8,000	26,000	20,654	12
mmary of period pr. 1, 1903, to ar. 21, 1904		2	48	9	15	108	37	145	283,500	7,875	13

sults of examination of Messalonskee Stream at pumping station of Maine Water Company, Waterville.

FEBRUARY, 1903.

Day.	Turbidity (parts per million).	Color (parts per million).	Bacteria per cubic centimeter.	Bacillus coli.[a]		
				In 0.1 c. c.	In 1 c. c.	In 10 c. c.
			370		+	+
			200		+	+
	3	28	230			
			265		+	+
	13	28	360		+	+
			375	+	+	+
			278		+	+
			248		+	+
			1,370	+	+	+
			2,800	-	+	+
			1,100	+	+	+
			655	+	+	+
			500	-	-	+
			385	+	+	+
			430	-	-	+
			260	-	+	+
			770	+	+	+
	1	28	330	-	-	+
	1	29	440	+	+	+
	0	28	350	-	+	+
	2	28	370	-	+	+
	4	30	590	+	+	+
	12	34	[b]1,860	-	-	-
Average	5	29	632			
cent giving positive test				50	82	95

[a] Plus sign indicates the presence and minus sign the absence of this organism.
[b] Average of seven observations.

Results of examination of Messalonskee Stream at pumping station of Maine Water Company, Waterville—Continued.

MARCH, 1903.

Day.	Turbidity (parts per million).	Color (parts per million).	Bacteria per cubic centimeter.	Bacillus coli.		
				In 0.1 c. c.	In 1 c. c.	In 10 c. c.
1	40	28	28,000	−	−	−
2	8	32	10,000	−	−	−
3	5	32	3,900	+	+	+
4	3	30	1,365	+	+	+
6	4	30	620	−	+	+
7	5	28	720	−	−	−
9	45	28	11,050	−	+	+
10	8	28	7,300	−	−	−
11	75	26	25,500	−	−	−
12	10	28	3,700	−	+	+
13	6	30	1,700	−	+	+
14	3	32	875	−	−	−
16	2	32	1,150	+	+	+
17	2	30	1,000	+	+	+
18	4	32	950	−	−	−
19	5	34	590	−	−	+
20	3	28	770	−	−	−
21	3	34	950	+	+	+
23	4	32	950	−	+	+
24	15	34	1,150	+	+	+
25	2	32	745	−	−	+
26	2	30	420	−	+	+
27	4	30	435	−	+	+
28	3	30	400	−	+	+
30	2	28	240	−	+	+
31	45	40	3,100	−	+	+
Average	12	31	4,138			
Per cent giving positive test				23	62	69

APRIL, 1903.

1	2	36	500	−	+	+
2	1	30	410	−	+	+
3	1	30	425	+	+	+
4	4	30	445	−	+	+
6	2	30	220	−	+	+
7	1	30	450	−	+	+
8	4	28	480	−	−	+
9	5	30	1,325	−	+	+
10	4	30	180	−	+	+
11	2	30	164	−	−	+
13	1	26	210	−	+	+
14	1	28	97	−	−	+
15	2	28	265	−	−	−
16	2	28	175	+	+	+
17	2	30	250	−	+	+
18	3	28	275	+	+	+
20	2	28	190	−	−	−
21	2	28	170	−	+	+
22	2	28	310	−	+	+
23	1	30	410	−	−	+
24	2	30	375	−	+	+
25	3	28	540	+	+	+
27	2	26	410	−	+	+
28	1	28	880	−	+	+
29	4	32	1,450	−	−	+
30	3	28	1,225	−	+	+
Average	2	29	455			
Per cent giving positive test				15	73	92

f examination of Messalonskee Stream at pumping station of Maine Water Company, Waterville—Continued.

MAY, 1903.

Day.	Turbidity (parts per million).	Color (parts per million).	Bacteria per cubic centimeter.	Bacillus coli.		
				In 0.1 c. c.	In 1 c. c.	In 10 c. c.
	22	32	1,425	+	+	+
	2	28	3,100	−	+	+
	2	28	1,150	−	+	+
	4	30	2,900	−	−	+
	6	28	4,150	−	+	+
	4	30	2,000	−	+	+
	2	30	2,650	−	−	+
	15	30	2,800	−	+	+
	10	30	1,300	−	+	+
	8	30	1,350	−	+	+
	2	30	2,200	+	+	+
	2	30	925	−	+	+
	2	28	940	−	+	+
	5	30	1,200	−	−	−
	2	30	550	−	−	+
	8	32	1,000	+	+	+
	2	24	[a] 20,000	−	+	+
	6	30	720	−	−	+
	6	28	600	−	−	−
	3	34	510	−	+	+
	2	26	475	−	+	+
	3	28	410	−	+	+
	2	30	685	−	−	+
	1	30	650	−	+	+
ge	5	29	2,237			
ring positive test				13	71	92

JUNE, 1903.

	2	32	[b] 185	−	−	+
	2	30	1,010	−	+	+
	3	28	850	+	+	+
	6	26	800	−	+	+
	4	28	830	+	+	+
	1	28	500	−	+	+
	5	30	1,750	+	+	+
	2	30	2,350	+	+	+
	3	30	2,900	−	+	+
	2	28	1,600	−	+	+
	[c] 39	[c] 42	[c] 15,050	+	+	+
	26	60	41,400	+	+	+
	8	64	5,500	+	+	+
	3	36	3,500	−	+	+
	2	34	2,700	+	+	+
	2	34	970	−	+	+
	2	30	1,250	+	+	+
	2	26	810	+	+	+
	1	26	290	−	−	+
	4	30	1,250	−	+	+
	2	28	960	+	+	+
	2	30	360	+	+	+
	2	30	410	+	+	+
	3	34	290	−	+	+
	5	26		−	−	+
	3	30	170	−	−	+
ge	5	33	3,507			
ring positive test				50	85	100

[a] Considerable amount of trash from bridge building on Western avenue.
[b] Pump not running.
[c] Average of two observations.

Results of examination of Messalonskee Stream at pumping station of Maine Water Company, Waterville—Continued.

JULY, 1903.

Day.	Turbidity (parts per million).	Color (parts per million).	Bacteria per cubic centimeter.	Bacillus coli. In 0.1 c. c.	In 1 c. c.	In 10 c. c.
1	3	30	300	−	+	+
2	5	26	510	−	+	+
3	6	26	500	−	−	+
6	6	28	.....	+	+	+
7	3	26	290	+	+	+
8	2	26	310	−	+	+
9	10	28	345	−	+	+
10	6	26	270	+	+	+
11	8	28	320	−	+	+
13	2	28	220	−	+	+
14	2	28	350	+	+	+
15	3	28	580	−	−	−
16	1	28	800	+	+	+
17	3	28	650	−	−	+
20	2	26	280	−	+	+
21	7	26	1,850	+	+	+
22	10	28	3,850	+	+	+
23	3	28	2,750	+	+	+
24	60	60	28,500	+	+	+
25	7	28	3,200	−	+	+
27	4	28	450	−	+	+
28	8	28	1,450	−	+	+
29	4	28	1,600	+	+	+
30	2	30	950	+	+	+
31	3	26	925	−	+	+
Average	7	29	2,138	.....	.....	.....
Per cent giving positive test	.....	.....	.....	44	92	9

AUGUST, 1903.

3	5	26	60	−	−	−
4	4	28	775	+	+	+
5	3	26	2,500	+	+	+
6	4	28	600	+	+	+
7	6	26	760	+	+	+
8	5	26	700	−	−	+
9	7	28	210	−	−	+
11	3	28	605	−	−	−
12	4	28	650	+	+	+
13	3	28	1,000	+	+	+
15	2	30	1,300	−	+	+
18	.....	.....	22,500	−	−	+
19	3	26	2,450	+	+	+
20	2	28	1,300	−	+	+
21	4	26	4,000	−	−	+
22	3	26	2,000	−	−	+
24	2	26	220	+	+	+
26	3	26	350	+	+	+
27	2	26	790	−	+	+
28	2	26	3,050	+	+	+
29	2	26	500	+	−	+
31	2	26	150	−	+	+
Average	3	27	2,112	.....	.....	.....
Per cent giving positive test	.....	.....	.....	41	64	91

sults of examination of Messalonskee Stream at pumping station of Maine Water Company, Waterville—Continued.

SEPTEMBER, 1903.

Day.	Turbidity (parts per million).	Color (parts per million).	Bacteria per cubic centimeter.	Bacillus coli. In 0.1 c. c.	In 1 c. c.	In 10 c. c.
	2	26	325	−	+	+
	2	26	555	−	−	+
	2	24	685	−	+	+
	1	24		−	−	+
	1		130	+	+	+
	2	26	130	+	+	+
	2	26	300	+	+	+
	1	26	470	+	+	+
	3	24	415	−	+	+
			200	−	−	−
	1	24	175	−	+	+
			400	−	+	+
			355	+	+	+
			360	+	+	+
			385	−	−	−
			250	−	−	+
Average	2	25	342			
ent giving positive test				37	75	88

CHEMICAL CONSTITUENTS.

The water of Kennebec River at all points above the Augusta dam soft. In fact, all of its chemical constituents are extremely low. is is to be expected from the general character of the basin, which ntains no beds of limestone and deposits of clay or minerals dily soluble in water.

The results of the chemical analys of the Kennebec water at terville and Augusta are given in tables on pages 182–183. These lts show that at Waterville the al solids in the water seldom eeded 50 parts per million. Of amount about 20 parts per lion represented hardness made of carbonates and sulphates in rly equal proportions. The alkaty varied from 8 to 12 and the rustants from 7 to 9 parts per lion. The amount of iron was her small.

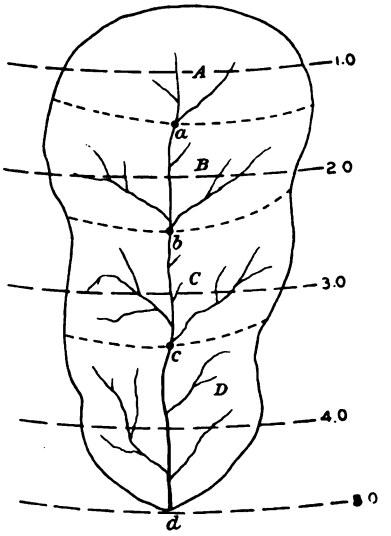


FIG. 11.—Diagram showing use of normal chlorine isochlors.

Above the Edwards Company's n at Augusta the amount of chlorine in the water is low at all nts, but it is less at the upper end than in the lower reaches of stream. This is chiefly because of the pollution of the river, ich increases downstream, but it is also due to the fact that the mal chlorine of the drainage basin becomes greater as the seacoast pproached.

The studies of the normal distribution of chlorine in the waters the State made by D. D. Jackson[a] show that the isochlor of 0.7 p per million passes through the geographic center of the Kennet basin and that the normal chlorine varies from 0.4 part per million the upper end of the stream to 6.0 parts per million at the mou Between these two points the normal chlorine gradually increases.

It must not be assumed, however, that the normal chlorine of t river at any particular point is the same as that shown by the isoch which passes through that point. It is shown rather by the isoch which passes through the geographic center of the basin above Thus the diagram shown in fig. 11 represents an imaginary drains basin divided into portions of equivalent area (*A*, *B*, *C*, and *D*) a gives the isochlors. The figures which truly represent the norm chlorine of the river water at the points *a*, *b*, *c*, and *d* are not 1.5, 2 3.5, and 4.5, as might at first be thought from an inspection of t isochlors, but at *a* the normal chlorine is 1.0, the result obtained integrating all the normals for the subdivision *A* above it; at *c* t normal is 1.5, the result obtained by integrating the normals for t regions *A* and *B*; and so on, until at *d*, the mouth of the stream, t normal chlorine is found to be 2.5 parts per million instead of 5.0, would be obtained if the reading were taken directly from the isochl

Chemical analyses of Kennebec River water above Waterville, January 19 to August 1903.

[Parts per million, unless otherwise stated.]

Date of collection.	Turbidity.	Color.	Odor.[b]	Nitrogen as—							Total solids.	Chlorine.	Total hardness.	Alkalinity.	Incrustants.	Iron.	Total microscopic organisms per cubic centimeter.	Amorphous matter
				Albuminoid ammonia.			Free ammonia.	Nitrites.	Nitrates.									
				In solution.	In suspension.	Total.												
January 19	2	37	2v.	0.092	0.004	0.096	0.002	0.000	0.05		46.0	0.8	31.0	12.0	19.0	0.15	44	
March 12	60	50	3v.	.118	.096	.214	.018	.001	.05		66.0	.7	17.0	9.0	8.0	....	76	3
April 18	10	40	3v.	.104	.004	.108	.010	.001	.10		49.0	.6	17.0	8.0	9.0	....	112	
May 23	5	36	3v.	.104	.022	.126	.016	.000	.00		43.0	.4	18.0	11.0	7.0	....	95	
June 23	5	56	3v.	.142	.008	.150	.028	.000	.00		39.0	.6	19.0	9.0	10.0	....	235	
August 17	3	38	3v. 2m.	.094	.028	.122	.012	.002	.00		48.0	.8	19.0	10.0	9.0	.20	170	
Average	14	43	.....	.109	.027	.136	.014	.001	.03		48.5	.7	20.2	9.8	10.3	....	121	

[a] The normal distribution of chlorine in the natural waters of New York and New England: Wa Sup. and Irr. Paper No. 144, U. S. Geol. Survey, 1905.

[b] Scale for odor is given on p. 173.

Chemical analyses of Kennebec River water at the intake of Augusta waterworks, August 25, 1903, to February 17, 1904.

[Parts per million, unless otherwise stated.]

Date of collection.	Turbidity.	Color.	Odor.[a]	Nitrogen as—						Total solids.	Chlorine.	Total hardness.	Alkalinity.	Incrustants.	Iron.	No. of bacteria per cubic centimeter, 48 hours at 20° C.	Bacillus coli.				Total microscopic organisms per cubic centimeter.	Amorphous matter per cubic centimeter.
				Albuminoid ammonia.		Total.	Free ammonia.	Nitrites.	Nitrates.								In 0.01 c. c.	In 0.1 c. c.	In 1.0 c. c.	In 10.0 c. c.		
				In solution.	In suspension.																	
1903.																						
August 25	5	32	3v. 1w.	0.088	0.018	0.106	0.008	0.001	0.00	44.0	0.8	21.0	13.0	8.0	0.20	260	.....	–	–	+	200	375
August 31	3	45	2v. 3w.	.126	.006	.132	.012	.000	.00	62.0	.8	17.0	15.0	2.0	.20	360	.....	–	–	+	90	100
September 8	4	39	2v. 3w.	.108	.000	.108	.014	.001	.05	53.0	.9	18.0	16.0	2.0	.10	260	.....	+	+	+	240	65
September 14	4	33	2v. 3w.	.110	.014	.124	.018	.001	.05	55.0	.6	17.0	15.0	2.0	.20	610	+	+	+	.....	615	625
September 21	4	34	1v. 3w.	.088	.010	.098	.010	.002	.00	53.0	.6	15.5	14.0	1.5	.15	615	–	–	+	.....	200	500
October 6	6	28	1v. 2w.	.084	.012	.096	.013	.001	.00	56.0	.7	16.0	13.0	3.0	.15	295	–	–	–	.....	145	185
October 19	6	30	2v. 1w.	.104	.010	.114	.019	.002	.05	64.0	.8	14.0	12.0	2.0	.10	630	–	+	+	.....	300	1,005
November 2	5	30	2v. 1w.	.114	.006	.120	.024	.002	.05	72.0	1.0	22.0	14.0	8.0	.20	725	–	–	–	.....	140	415
November 16	8	32	2v. 1w.	.112	.004	.116	.030	.002	.00	62.0	1.3	20.0	16.0	4.0	.15	830	.....	–	+	+	85	375
December 7	7	30	2v. 1w.	.116	.008	.124	.033	.002	.05	58.0	1.5	19.0	16.0	3.0	.15	3,330	.....	–	+	+	70	210
December 21	10	28	2v. 1w.	.098	.010	.108	.038	.001	.05	60.0	2.2	21.0	17.0	4.0	.10	3,900	.....	+	+	+	50	180
1904.																						
January 12	5	38	2v. 2w.	.104	.006	.110	.026	.001	.05	57.0	1.4	23.0	18.0	5.0	.10	38,000	.....	–	–	–	85	120
January 26	2	26	2v. 2w.	.112	.014	.126	.014	.000	.10	54.0	1.3	23.0	19.0	4.0	.10	20,000	.....	–	+	+	60	65
February 17	7	22	2v. 2w.	.102	.026	.128	.012	.001	.05	60.0	1.4	22.0	16.0	6.0	.15	19,000	.....	–	–	+	635	170
Average	5.3	32	2v. 2w.	.105	.010	.115	.019	.001	.04	57.8	1.06	19.1	15.3	3.9	.15	.....	.....	.....	.....	.....	.....	.....

[a] Scale for odor is given on p. 173.

On this basis the following approximate figures have been obtained for the normal chlorine of the Kennebec River water at various points, and side by side with these is given the normal chlorine for the local water sources at the same points.

Normal chlorine in Kennebec River basin.

[Parts per million.]

Place.	Taken from nearest isochlor.	Calculated from isochlors over whole basin.
Solon	0.6	0.
Skowhegan	.75	.
Waterville	1.0	.
Augusta	2.0	.
Richmond	3.0	.

The absence of mineral matter makes the Kennebec water excellent for use in boilers and in connection with paper making and many other industries where chemicals are used. The low alkalinity, however, is something of a disadvantage in purifying the water by the mechanical system of filtration, in which alum is employed as a coagulant, as it necessitates the occasional use of soda.

The suspended matter in the Kennebec water was largely organic except after heavy rains, when, as already pointed out, it was composed chiefly of river silt. The amount of dissolved organic matter corresponds well with that usually found in waters of similar color.

No analyses of the water were made at points above all sources of pollution, but the analyses made at Waterville, above which the amount of pollution is comparatively small, represent a near approach to natural conditions. The free ammonia was very low, indicating that decomposition of organic matter was inactive; the amounts of nitrogen as nitrites and nitrates were also very small.

MICROSCOPIC ORGANISMS.

The numbers of microscopic organisms in the river water were found to be very small, although they were higher than in many other streams. These higher numbers may have been due to the fact that the basin contains so many lakes, in which these organisms find favorable conditions for development. The results of the microscopical examinations are given in the accompanying tables. The amorphous matter varied considerably at different times, as described under the heading "Turbidity" (p. 169). It consisted very largely of broken-down organic matter, in which vegetable filaments and fragments of wood fiber were conspicuous. This woody fibrous matter was much more abundant at Augusta than at Waterville, probably on account of the waste products from the Hollingsworth & Whitney paper mill at Winslow.

Microscopic organisms in samples of water from Kennebec River collected at Waterville, 1903.

[Standard units per cubic centimeter.]

Organism.	January 19.	March 12.	April 18.	May 23.	June 23.	August 17.
Synedra	16	10		10		
Asterionella			8	25		
Tabellaria			15	15	40	
Diatoma				5		
Melosira		15			50	
Cyclotella						
Closterium		5	5	25	40	10
Scenedesmus					10	
Cladothrix	28	12	15			
Anthophysa		34	09	15	55	135
Actinophrys						25
Mastigocerca					40	
Total organisms	44	76	112	95	235	170
Amorphous matter	300	3,000	800	40	60	65
Vegetable fiber	8					

Microscopic organisms in samples of water from Kennebec River collected at intake of Augusta waterworks, 1903–4.

[Standard units per cubic centimeter.]

Organism.	August, 1903.		September, 1903.				October, 1903.		
	25.	31.	8.	14.	21.	6.	13.	19.	26.
Diatomaceæ:									
Asterionella	5		10	35			10	10	
Cyclotella	5								10
Navicula	5	15							
Synedra	5		15	225	5		35	20	40
Tabellaria	10	15							
Melosira			15	20	20	25	40		130
Stephanodiscus								10	
Chlorophyceæ:									
Staurogenia	10						15		
Draparnaldia	40								
Closterium			25						
Dictyosphærium			40				40	40	
Protococcus			20						
Scenedesmus					10		25		
Cyanophyceæ:									
Microcystis	25		65	25				50	
Oscillaria		25			25		25		
Cœlosphærium				25	25				
Clathrocystis						40			
Fungi and schizomycetes:									
Crenothrix	40	35							
Leptothrix			50	165	55	70	105	110	60
Protozoa:									
Glenodinium	10								
Dinobryon	25			25					
Paramæcium	20								
Anthophysa				95	25			20	
Chlamydomonas					10				
Trachelomonas						10	5		
Synura								40	
Rotifera:									
Anuræa					25				
Total organisms[a]	200	90	240	615	200	145	300	300	240
Amorphous matter[b]	375	100	65	625	500	185	400	1,005	675
Vegetable and woody fiber	65	55	65		60				

[a] Average, 224.

[b] Average, 346.

Microscopic organisms in samples of water from Kennebec River collected at intake of Augusta waterworks, 1903–4—Continued.

Organism.	November, 1903.			December, 1903.			January, 1904.		February, 1904.
	2.	9.	16.	1.	7.	21.	12.	26.	17.
Diatomaceæ:									
Asterionella	10		10	10		10	15	25	5
Navicula									10
Synedra	5	250	10		15		10	5	5
Tabellaria	10								
Melosira	10	20						5	
Meridion					5				
Cyanophyceæ:									
Microcystis		40							
Fungi and schizomycetes:									
Leptothrix	105	50	25	145	50	30	60		615
Protozoa:									
Anthophysa			40						
Actinophrys				40		10		25	
Cryptomonas								10	
Total organisms[a]	140	385	85	195	70	50	85	60	635
Amorphous matter[b]	415	500	375	270	210	180	120	65	170

[a] Average, 224.

[b] Average, 346.

BACTERIA.

The number of bacteria in the water of Kennebec River at Waterville varied during the course of the observations from 110 to 15,000 per cubic centimeter. In general, the high figures were found at times of large stream flow. Not enough analyses were made to give a fair annual average.

No attempt was made to determine the prevailing species of bacteria in the water, but many presumptive tests were made to show the presence of *Bacillus coli*. Laboratory experiments at Waterville showed that under the local conditions this test gave a very fair indication of the actual presence of this organism, a result which is not everywhere obtained. Positive indications of the presence of *B. coli* were shown in 94 per cent of the 10 c. c. samples tested at Waterville, 81 per cent in the 1 c. c. samples, and 30 per cent in those of 0.1 c. c. The results of these observations are given in the tables on pages 172–177.

EFFECT OF TIDES ON QUALITY OF THE WATER BELOW AUGUSTA.

The lower part of Kennebec River may be considered a narrow tidal estuary, in which the tide ebbs and flows to the foot of the Edwards Company's dam at Augusta. Under ordinary conditions of stream flow the water is fresh nearly to the mouth of the river, but at times brackish water extends nearly to Augusta. Yet the public water supply of Richmond is obtained from the river.

Few analyses of the river water at points below Augusta have been made, but one series of analyses made at Richmond through a course of tides serves well to illustrate the variations which take place in the chlorine content of the water at different stages of the tide.

December 9, 1903, the flow of the river at Winslow was 1,351 second-feet, which is extremely low. Samples were collected at the surface and at the bottom of the river opposite the Richmond steamboat wharf and tested for chlorine. The elevation of the water surface was also read from the gage of the United States Coast and Geodetic Survey on the steamboat wharf. The results of these analyses are given in the subjoined table, and are also shown by fig. 12. From this diagram it will be seen that the chlorine in the water varied from 50

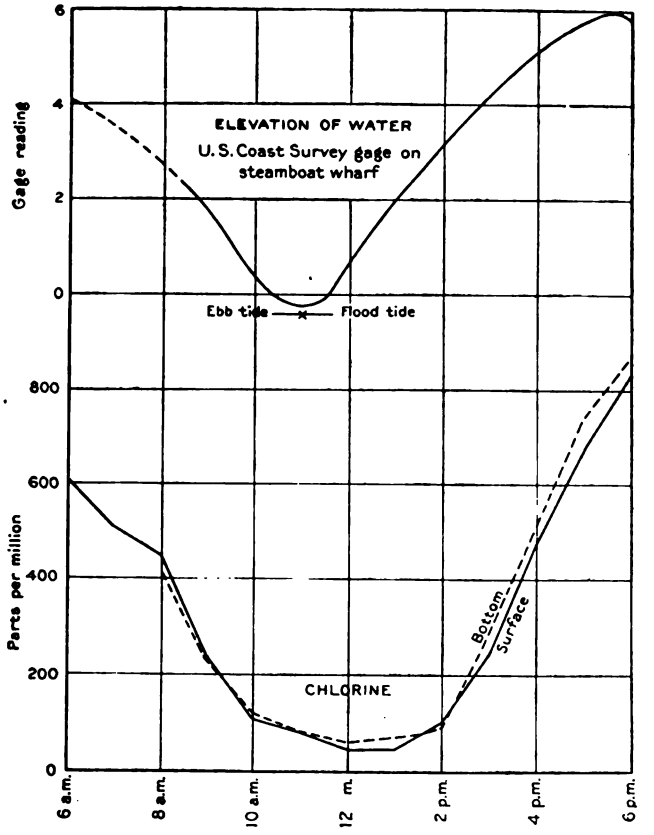


FIG. 12.—Fluctuations of chlorine in Kennebec River water at Richmond, December 9, 1903.

to 870 parts per million between low and high tide. As a water tastes brackish when the amount of chlorine exceeds 150 parts per million, it will be seen that the river water and consequently the public water supply of Richmond on the date mentioned was noticeably brackish for about two-thirds of the time. The diagram also shows that the time of minimum saltness occurred just after low tide, and the time of maximum saltness just after high tide. It is interesting to observe further that there was a conspicuous under run of sea water on the

flood tide; thus when the tide was running in, the water at the bottom of the river was salter that at the surface. This is a phenomenon common to all tidal estuaries.

On February 5, 1904, two samples of water were collected from the river at 4.30 p. m., when the tide was running in. The surface water contained 136 parts of chlorine per million, and the water at the bottom contained 194 parts per million. To judge from the stream flow between December 9, 1903, and February 5, 1904, there is good reason to believe that throughout the winter the public water supply at Richmond was more or less brackish.

Chlorine in water of Kennebec River, elevation of water surface, and direction of current at Richmond, Me., December 9, 1903.

Hour.	Chlorine (parts per million).		Gage height (feet).[a]	Direction of current.
	Surface.	Bottom.		
6 a. m.	610			Downstream.
7 a. m.	510			Do.
8 a. m.	450	420		Do.
8.30 a. m.			2.15	Do.
9 a. m.	240	230		Do.
9.30 a. m.			1.15	Do.
10 a. m.	110	120		Do.
10.30 a. m.			—0.10	
11 a. m.	80	80		No current.
11.30 a. m.			—0.05	
12 m.	50	60		
12.30 p. m.			1.38	Upstream.
1 p. m.	50	70		
1.30 p. m.				Do.
2 p. m.	100	95		
2.30 p. m.			3.25	
3 p. m.	250	280		Do.
3.30 p. m.			4.70	
4 p. m.	480	510		Do.
4.30 p. m.			5.60	
5 p. m.	670	740		Do.
5.30 p. m.			5.90	
6 p. m.	830	870		Do.
6.15 p. m.			5.40	

[a] Read on gage of United States Coast and Geodetic Survey.

POLLUTION.

SOURCE AND CHARACTER.

The general pollution of the Kennebec River water at various points is usually measured by the density of population dwelling on the drainage area above those points, because either directly or indirectly the waste products of life and industry are washed into the river and carried to the ocean. Although this is true, the greatest effect on the quality of the water is produced by that part of the population which discharges sewage and manufacturing wastes directly into the river or its tributaries. This is more liable to be the case where the population is concentrated in villages and cities than where it is widely scattered, because compact settlements are more likely to be provided with sewers, which discharge, with or without purification, into some watercourse. The division of the total popu-

ıtion into the classes "rural," "village," and "urban" furnishes a onvenient and, on the whole, satisfactory basis for estimating its ırobable influence on the water. In the present discussion these lasses are defined as follows: Rural, communities having fewer than ,000 inhabitants; village, communities having between 1,000 and ,000 inhabitants; urban, communities having more than 4,000 nhabitants.

On this basis the population per square mile has been determined or the drainage areas of the principal tributary streams of the Kenıebec and at various points along the main stream. The results are hown in the following table and in fig. 13:

Drainage area and population of Kennebec basin at various points.

	Distance in miles.	Drainage area.	Population.				Population per square mile.			
			Rural.[a]	Village.[b]	Urban.[c]	Total.	Rural.[a]	Village.[b]	Urban.[c]	Total.
oosehead Lake, at outlet	0	*Sq. m.* 1,240	1,730	0	0	1,730	1.6	0	0	1.6
etween Moosehead Lake and Dead River		330	210	0	0	210	0.6	0	0	0.6
Total above Dead River		1,570	1,940	0	0	1,940	1.2	0	0	1.2
ead River	24	870	1,130	0	0	1,130	1.3	0	0	1.3
etween Dead River and Carrabassett River		350	250	0	0	250	0.7	0	0	0.7
Total above Carrabassett River		2,790	3,320	0	0	3,320	1.2	0	0	1.2
arrabassett River	60	395	3,370	0	0	3,370	9.0	0	0	9.0
etween Carrabassett River and Sandy River		35	610	1,380	0	1,990	18.0	39.0	0	57.0
Total above Sandy River		3,220	7,300	1,380	0	8,680	2.2	0.4	0	2.7
andy River	68	670	6,820	6,330	0	13,150	10.0	9.0	0	19.0
etween Sandy River and Waterville		380	3,520	6,760	5,180	15,460	9.0	18.0	14.0	40.0
Total above Waterville	98	4,270	17,640	14,470	5,180	37,290	4.0	3.8	1.2	8.7
essalonskee Stream	99	210	2,450	2,940	0	5,390	12.0	14.0	0	26.0
'basticook River		970	11,580	13,760	0	25,340	12.0	14.0	0	26.0
etween Waterville and Augusta[d]		130	950	2,060	10,480	13,490	7.3	16.0	80.0	103.0
Total above Augusta	116	5,580	32,620	33,230	15,660	81,510	5.8	5.9	2.8	14.4
obbosseecontee Stream	122	240	5,470	3,070	0	8,540	22.0	12.0	0	36.0
etween Augusta and Merrymeeting Bay[e]		150	1,840	7,940	10,690	20,470	12.0	53.0	71.0	136.0
Total above mouth of Kennebec River	141	5,970	39,930	44,240	26,350	110,520	6.7	7.5	4.4	18.5

[a] Communities with less than 1,000 inhabitants.
[b] Communities with 1,000 to 4,000 inhabitants.
[c] Communities with more than 4,000 inhabitants.
[d] Omitting the Messalonskee and Sebasticook.
[e] Omitting the Cobbosseecontee.

For the first 60 miles of its course the river is practically unpolluted. here are no cities or important villages, the population being mainly ı lumber camps and a few settlements of summer visitors. The ıral population per square mile is very low. Along the middle

course of the river there are numerous villages, and lower down are the cities of Skowhegan, Waterville, Augusta, and Gardiner. In all there are on the Kennebec drainage area 115 cities, towns, and villages, with population as follows:

Population in towns in Kennebec basin.

Population.	Number of communities
0–1,000	86
1,000–2,000	16
2,000–5,000	9
5,000–10,000	2
10,000–20,000	2
	115

The distribution of these communities over the drainage area is shown in fig. 14.

The greatest amount of pollution is contributed by the cities

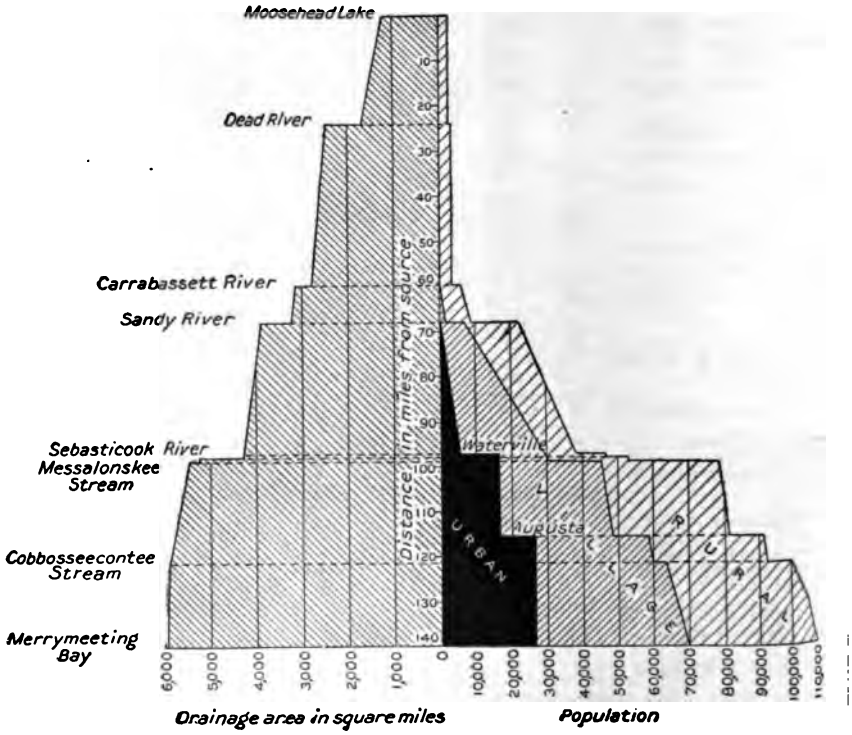


FIG. 13.—Diagram showing drainage area and population above various points on Kennebec River.

towns located directly on the river and its main tributaries. These cities are Madison, Skowhegan, Pittsfield, Newport, Waterville, Augusta, Gardiner, and Richmond, and all of them discharge sewage directly into the stream. At the Augusta waterworks bearing

stimated that about 13,000 people discharged sewage into
above the intake. The ordinary dry-weather flow of the
t this point was considered as 0.25 second-foot for each 1,000

p showing principal sources of pollution in Kennebec River basin and normal isochlors.

contributing sewage. This represents a substantial dilution
e—enough to prevent visible nuisance. It does not, how-
der the water safe for drinking.

Sewage and manufacturing wastes discharged into Kennebec and Sebasticook rivers above Augusta.

Sources of pollution.	Distance above Augusta intake.	Persons using public sewers.	Persons in mills.	Persons using privies or private sewers.	Manufacturing wastes discharged daily.							
					Woolen mills.				Paper and pulp mills.			
					Spent dye.	Preparatory liquor.	Soap.	Wash water.	Groundwood wash.	Sulphite wash.	Paper machine.	Spent sulphite liquor.
	Miles.				*Gallons.*	*Gallons.*	*Pounds.*	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*	*Gallons.*
Waterville	17.1	3,372										
Lockwood Manufacturing Co			1,300									
Riverview Worsted Co			250		10,000		600	30,000				
Waterville Iron Works				30								
Colby College				88								
Maine Central R. R. roundhouse			100									
Maine Central R. R. car shops			295									
Chase Manufacturing Co			65		750		30					
A. P. Emery [a]												
Hayden Brook				36								
Winslow	17.1											
Hollingsworth & Whitney Co			650						3,000,000	2,000,000	250,000	140,000
Fairfield	20.6											
Fairfield Furniture Co			35									
Gristmill			4									
Electric power station			5									
United Box Board and Paper Co			13									
American Woolen Co			175		5,000	5,000	80					
Shawmut	23.8											
United Box Board and Paper Co			80									
Lawrence Newhall & Page Co			240						200,000			
Skowhegan	34	1,516		140								
American Woolen Co			175		10,000	10,000	340	30,000				
Marston Worsted Co			275		6,000		75	40,000				
Commonwealth Shoe and Leather Co			250									
Bowdoin Pulp Co			10									
Skowhegan Pulp Co			25						50,000			
Electric Light Co			5									
Currier Brook				39								
Madison	46	636										
Madison Woolen Co			200		7,000		300					
Indian Spring Woolen Co			200		5,000	5,000	150					
Great Northern Paper Co										1,500,000	1,500,000	120,000
North Vassalboro	21.4											
American Woolen Co			300		6,000	2,000	500					

R. Dotson & Co.											
Waverley Woolen Co.			175		4,000						
Riverside Woolen Co.			110		600		125				
Newport	44.5	442		4							
Newport Woolen Co.			150		5,000	5,000	250				
Weymouth Wool Co.[b]			45								
Borden Condensed Milk Co.			30								
		7,466	5,608	337	61,350	35,500	2,700	100,000	3,250,000	3,500,000	1,750,000	200,000

[a] Pulls 300 sheepskins per week for 12 weeks.

[b] Pulls 1,250 sheepskins per day.

The manufacturing wastes emptied into the stream at various places are a more important factor in the general pollution of the stream than are the city sewers, if the use of the water for drinking purposes is disregarded. Woolen mills, paper mills, and various other industries are located at the developed water powers and many of them contribute large quantities of spent liquors of a highly objectionable character. Some idea as to the quantity of these discharged wastes may be had from the accompanying table, which, however, includes only those above the waterworks intake at Augusta and only those located in the largest cities and towns. These manufacturing wastes form about 1 per cent of the flow of the stream at low stages.

The two most important sources of pollution are the paper mills of the Great Northern Paper Company at Madison and those of the Hollingsworth & Whitney Company at Winslow, both of which discharge several million gallons a day of wash water and spent liquors. At Madison the sulphite process is used; the Winslow mills use both the sulphite and the ground-pulp processes.

In the sulphite process the disintegration of the wood fiber is accomplished by the use of the acid sulphites of calcium and magnesium, which are manufactured by burning sulphur and carrying the fumes into an "acid tower," packed with crushed lime or limestone, water being allowed to trickle down as the fumes ascend. The bisulphite solution runs out at the bottom of the tower and is pumped to the digesters, where the chipped wood to be treated is closely packed. Digestion under high pressure is continued for several hours, and the contents are then delivered into a pit, from which the waste liquor drains away to the river, leaving the fiber behind. This waste liquor has the appearance of molasses, but is much thinner. It has a sulphurous, acrid, woody odor. It generally contains from 0.5 to 1 per cent of sulphurous acid and often contains 10 to 15 per cent of solid matter, a part of which is fine wood fiber. The chemical constituents of the soluble portion of this spent sulphite liquor are extremely complex and are not well known. No attempt has been made to utilize the liquor or to purify it before letting it run into the river. After it has drained away, the sulphite pulp is carried to washers, when it is washed and sifted and ultimately worked into a "blanket," in which condition it is ready for paper making. The washings from this pulp contain considerable amounts of wood fiber and of course some of the sulphite liquor. The wash water after screening is allowed to run into the river. At Madison between 5 and 6 tons of sulphur are burned a day and at Winslow about 8 tons; the amounts of lime are about 7 or 8 tons a day at each place. Each plant discharges from 100,000 to 150,000 gallons a day of spent sulphite liquor and from 1,500,000 to 2,000,000 gallons of sulphite wash water. At the Hollingsworth &

plant there is in addition about 3,000,000 gallons a day of ood wash.

l-wood pulp is made by pressing short lengths of logs against tone grinder kept wet with water. The pulp thus produced washed and screened and deposited as blankets. The wash ntains a large amount of wood fiber and extractive matter, ıe whole, it is much less objectionable than the sulphite wash: on to the wash water from the pulp manufacture there is a ıble quantity of wash water from the paper machines; this ains more or less wood fiber. Altogether, about ten per cent od pulp manufactured may be considered as passing off into m as waste.

rfield the soda process is used. In this process the wood is hips and digested in a liquor, which consists chiefly of caustic de by cooking soda ash with limestone. The spent liquor s process is subjected to a recovery treatment, which con- vaporating the liquor in digesters and adding lime. As a this treatment much of the soda can be used over again; ə produced is chiefly calcium carbonate. During the process, about 12 per cent of the soda is lost. The pulp from the is washed, drained, and worked into the usual blanket form. cotton mills there is comparatively little waste of an objec- character, although small amounts of the spent bleach liquor d to the stream. At the gas works more or less tar and oily re discharged. At the woolen mills the waste products are jectionable. They consist of the spent preparatory liquor, ntains bichromate of potash, lactic acid, spent dyestuffs, such od and various aniline dyes, and large quantities of potash here are in Waterville a few ironworks which discharge acid

iving on Kennebec River deserves important mention in con- vith the subject of pollution. In 1903 the logs driven on the ounted to nearly 150,000,000 feet B. M. They consist chiefly , poplar, and pine, cut on the drainage basins of Moosehead l Dead River. The run usually lasts from April to July, and is time from 100 to 500 men are constantly employed along m.

EFFECTS OF POLLUTION.

fect of pollution of the river at Waterville on the quality of r as used at Augusta was studied with some care in connec- . the appraisal of the Augusta waterworks. It was a common ong the water consumers in Augusta that they could taste in water the paper-mill waste supposed to be put into the river

by the mills at Waterville. As there were various sources of pollution at Waterville, no attempt was made to discriminate between them so far as they affected the water at Augusta, but some experiments and calculations were made to show the relative importance of the Waterville sewage and the wastes from the Hollingsworth & Whitney Company's plant.

It will be convenient to consider the effect of some of these sources of pollution on the various characteristics of the water.

EFFECT ON TURBIDITY.

That the paper-mill discharges at Waterville and at other points on the river influence the turbidity of the water at Augusta was very evident from the microscopic examinations of the sediments in the samples collected at the Edwards Company's dam. These were found to contain an abundance of woody fiber, which evidently came from the fine pulp that had escaped through the screens at the paper mills. Fibers of linen and wool were also discerned, but in much smaller numbers. When it is considered that about 10 per cent of the wood fiber is wasted in the process of paper making, it will readily be understood that the quantity of waste material put into the river is very great. Much of this fiber forms deposits in the bottom of the stream and on twigs, waterweeds, etc., along the shore, and these may be seen by an inspection of the river. At times of high water, however, the deposits are washed away and carried downstream to settle again at some lower point, but ultimately to reach the ocean.

EFFECT ON COLOR.

The effect of the sulphite waste on the color of the river water is probably small. A sample of it taken at the Hollingsworth & Whitney Company's plant had a color of 320. At times of average flow this would be diluted by about 272 parts of water. Therefore, under average conditions, the sulphite wash would increase the color of the water by less than 2 on the platinum scale. Under the most severe conditions of minimum flow, however, when the dilution would be only 1 in 20, this effect on the color would be very noticeable. At such times, however, the works are often shut down on account of lack of power, so that these extreme conditions of pollution would seldom prevail.

EFFECT ON ODOR.

That the people of Augusta were correct in thinking that the sulphite wastes from the Hollingsworth & Whitney paper mills at Winslow affected the taste of their water supply was demonstrated by experiments made in the State hygienic laboratory at Augusta. A

ample of sulphite waste liquor was diluted with distilled water to arious degrees to ascertain at what dilution the odor of the waste ecame unnoticeable. The original liquor had a strong odor suggestve of wood and sulphurous acid. Its color was 320; its acidity 1,500 arts per million. This odor was still marked when the sample was iluted 1 to 500, and it could be detected until the dilution reached 1 to 25,000, which was placed as the limit. A sample of wash water from the grinder lost its woody odor when diluted 1 to 500.

The effect of the discharge of sewage in Waterville on the odor of the river water could be detected for several miles down the stream, but after a time the odor became masked by the stronger odor due to the sulphite wastes.

EFFECT ON CHEMICAL CONSTITUENTS.

The effect of the stream pollution on the chemical quality of the river water between Augusta and Waterville is noticeable in the analyses, although not conspicuously large. The average amount of chlorine increased from 0.7 to 1.06 parts per million; the alkalinity increased from about 10.0 to 15.0 parts. Comparatively few chemical analyses were made of samples collected up and down the river on the same date, so that strict comparisons of the effect of pollution are not available.

EFFECT ON BACTERIA.

One effect of the discharge of sewage at Waterville was to increase considerably the numbers of bacteria in the water. This was clearly shown by numerous samples collected up and down the river between Waterville and Augusta. Two series of bacterial counts, made at intervals of 1 mile between Waterville and Augusta on November 23, 1903, and February 26, 1904, were especially interesting. The first series was taken when the river was open; the second when the surface was covered with ice. The results obtained are shown in the following table:

Bacteria per cubic centimeter in the water of Kennebec River at various points between Waterville and Augusta before and after the river was frozen.

Distance below Waterville sewer.	November 23-24, 1903 (river open).	February 26-27, 1904 (river closed).	Distance below Waterville sewer.	November 23-24, 1903 (river open).	February 26-27, 1904 (river closed).
Miles.			*Miles.*		
Just below...	30,000	22,000	9.....	1,475	25,000
1.....	2,300	20,000	10.....	1,645	30,500
2.....	4,200	36,000	11.....	1,245	20,000
3.....	3,650	40,000	12.....	1,130	31,000
4.....	2,520	43,000	13.....	1,200	31,000
5.....	2,040	28,000	14.....	910	32,000
6.....	1,830	30,500	15.....	1,025	38,000
7.....	1,650	29,000	16.....	875	34,000
8.....	1,420	19,500	[a]17.....	960	25,000

[a] Augusta intake.

In November, the river being open, the number of bacteria gradually decreased from 30,000 per cubic centimeter immediately below the outlet of the Waterville sewer to 860 at the intake of the Augusta waterworks. In February, on the contrary, the number of bacteria remained substantially the same throughout the district, being 22,000 per cubic centimeter at a point just below the Waterville sewer and 25,000 at the Augusta intake. From the standpoint of the self-purification of streams these figures offer an interesting comparison and may help to throw some light on the fact, often noticed, that stream pollution appears to be most dangerous to water supplies during the winter months. The summary of analyses given in the table on p. 177 shows that with the freezing over of the river there was a rapid deterioration in the bacterial condition of the Augusta water supply. The approximate average numbers of bacteria per cubic centimeter during the different months from August, 1903, to March, 1904, were as follows:

Average number of bacteria per cubic centimeter in water of Kennebec River, August, 1903, to March, 1904.

August	300
September	450
October	525
November	625
December	7,900
January	33,000
February	25,000
March	21,000

The effect of the Waterville sewage on the quality of the river water was also convincingly shown by the presence of large numbers of *Bacillus coli* in the water at Augusta. During the eight months from August, 1903, to March, 1904, 72 per cent of the samples tested with 10 c. c. of water gave positive tests for *Bacillus coli*, 62 per cent with 1 c. c., and 36 per cent with 0.1 c. c.

Evidence more convincing even than these figures that the water of Kennebec River below Waterville is unfit for domestic use without purification is furnished by the typhoid-fever statistics for Augusta, which are given below.

TYPHOID FEVER EPIDEMIC OF 1902-3.

INTRODUCTION.

That the contamination of Messalonskee and Kennebec rivers was the direct cause of the typhoid-fever epidemics which occurred in Waterville and Augusta during the winter of 1902–3 seems to have been established beyond question. The following account of these epidemics is quoted from a paper presented to the New England

Waterworks Association in February, 1905, by George C. Whipple and Dr. E. C. Levy:[a]

The recent appraisals of the waterworks of Waterville and Augusta, Me., necessitated a careful study of the typhoid-fever epidemic which swept through the Kennebec Valley during the winter and spring of 1902–3. At the time when this epidemic occurred the plan of municipal ownership through the agency of "water districts" had been suggested and the law had been pronounced constitutional by the courts. The bad quality of the water supplied to these communities had much to do with this demand for public ownership, and the outbreaks of typhoid fever naturally hastened the actions which had been contemplated. The epidemic itself presented no novel features and its history is much the same as that of many other epidemics of typhoid fever due to public water supplies. Its magnitude, however, makes it deserve a place among the important epidemics of the country. * * *

The city of Waterville and the neighboring towns of Fairfield, Winslow, and Benton were, at the time of the epidemic, supplied by the Maine Water Company with water from the Messalonskee Stream. This stream has a watershed of 205 square miles above the pumping station and drains a chain of seven large lakes which have a combined water surface of 27.5 square miles. Upon this watershed there dwells a population of something over 5,000 persons, or about 27 per square mile. The upper portions of the watershed are comparatively unpolluted, but at the outlet of Messalonskee Lake is the town of Oakland, which has a population of approximately 2,000. At this place, which is only 7 miles above the pumping station of the Maine Water Company at Waterville, sewage is discharged from several private sewers. Along the stream are a number of mills, the most important of which are the Oakland and Cascade woolen mills, the mills of the Dunn Edge Tool Company and the Emerson & Stevens Company. They contribute not only a considerable amount of fecal matter, but wool washings, dyestuffs, and other kinds of manufacturing wastes. The Messalonskee River between Oakland and Waterville flows rapidly during the first half of its course and then somewhat more slowly as it feels the effect of the backwater of the waterworks dam. The time required for the water to flow from Oakland to Waterville is often only a few hours. The Maine Water Company had also the right to use the water of the Kennebec River. This water has been seldom used, although just prior to the epidemic it was pumped into the city for a short time because of a fire which occurred at Colby University. During the dry spell of last autumn (1904) it was again used, as the flow of the Messalonskee became insufficient to operate the pumps.

As might be naturally expected from the surroundings, the water at the pumping station of the Maine Water Company showed decided indications of pollution. Under ordinary conditions the water was light colored and fairly clear, but after rains it became turbid and heavily laden with bacteria. At all times the intestinal germ, *Bacillus coli*, was present in large numbers.

Prior to 1901 the typhoid-fever death rate in Waterville had not been especially high. During 1901 and 1902, however, the rate increased to more than 80 per 100,000, but it was not until the autumn of 1902 that the typhoid situation became serious.

The city of Waterville is fairly well provided with sewers, and at Waterville, Winslow, and Fairfield there are a number of mills which have privies directly over the stream.

About 18 miles below Waterville is the city of Augusta, the capital of the State. Augusta takes its water supply directly from the Kennebec River at a point just above the city, near the Kennebec dam. Until recently the works were owned by the Augusta Water Company. The river water was pumped to a reservoir, but was first passed through an old Warren filter, one of the first of its kind in America. This was a filter only in name and should have been more properly called a strainer. Analyses

[a] Jour. New England Waterworks Assoc., vol. 19, No. 2.

indicated that its bacterial efficiency was practically nil. As would be naturally expected, the river water at Augusta was found to be polluted. This was shown by the analyses which were made daily for several months, but it was even more strongly demonstrated by the typhoid-fever statistics of the city.

The water of the Kennebec River just below Waterville showed at all times evidences of gross pollution. During its flow of 17 miles to Augusta its bacterial quality appeared to improve somewhat. In the summer this improvement was much more noticeable than during the winter, when the river was covered with ice. Float experiments which were made indicated that the time required for water to flow from one place to the other was about three days at times when the discharge of the stream was small. At times of flood this period is probably not much, if any, more than twenty-four hours.

The Augusta Water Company also controlled and used a spring water supply known as the Devine water. In some houses this was used exclusively; in others both this and the river water was used. The quality of this water was poor, but better than that of the river.

The sewers of Augusta discharge into the river and there are several mills along the shore which pollute the water.

The town of Richmond, 15 miles below Augusta, also takes its water supply from the Kennebec River. The conditions there are such that the main current of the stream flows to the east of Swan Island, while the intake of the waterworks is located in the west channel. The river at Richmond is considerably affected by the tides; in fact, the town water is at times brackish. Thus, while the town uses the water which receives the sewage of Augusta, Waterville, and other cities, the tidal conditions tend somewhat to lessen the effect of this upstream pollution, although they increase the danger from local sources.

GENERAL ACCOUNT OF THE TYPHOID-FEVER EPIDEMIC.

The typhoid-fever epidemic of 1902–3 began about the middle of November, 1902. It was first noticed at Waterville, where for about a month new cases were reported at the rate of one a day. On Christmas day there were five new cases and during the next week the daily number of cases was the same. Thirteen were reported on New Year's day. After the middle of January the number of new cases fell off, but they continued to be reported at intervals until March. In Fairfield, Winslow, and Benton typhoid fever occurred at the same time. The largest number of cases was reported during the first two weeks of January. These four communities had the same water supply, namely, that of the Messalonskee River, and from the first it was evident that this was the cause of the epidemic.

As the sewage of these typhoid-fever stricken communities emptied into the Kennebec River and as the water of this river furnished the supply of Augusta, it was almost inevitable that the epidemic should extend to that city also, and this is what actually occurred. During the latter part of November and the whole of December new cases of typhoid fever occurred daily in Augusta. It seems probable that these earlier cases were due to the same source of infection that caused the epidemic at Waterville, inasmuch as the Messalonskee River, which supplied that city, discharges into the Kennebec above Augusta. It was not until about two weeks after the climax of the Waterville epidemic that the serious period of the Augusta epidemic began. During the latter part of December and throughout the months of January and February the sewage at Waterville must have been infected with typhoid-fever bacilli; and, making due allowances for the periods of sickness, transmission, and incubation, this time corresponded with the duration of the epidemic at Augusta. After the Waterville epidemic had ceased and sufficient time had elapsed for the patients to recover the epidemic at Augusta came to an end.

:hmond, which is only a small village, typhoid fever did not occur until the of January, but occasional cases appeared during the next two or three months e plainly connected with the epidemic of the cities above.

ity of Gardiner is situated between Augusta and Richmond. It does not take supply from the Kennebec River, but from the Cobbosseecontee River. This no epidemic, although a number of cases of typhoid fever occurred there. hese were contracted at Augusta. The same was true also of the town of Hal-

5 shows chronologically the progress of this epidemic, together with certain hich affected it. It indicates that the epidemics in the different communi- ied a connecting series and may be really considered as one epidemic, inas- they started from a common cause. In all there were about 612 cases and 53

* * *

TYPHOID FEVER IN WATERVILLE.

GENERAL ACCOUNT.

dying the Waterville epidemic the first step taken was to secure with as much as possible certain information in regard to each case of typhoid fever. Printed ere first distributed among the physicians, who were requested to fill them out ish any other important facts known to them in regard to each case of typhoid ich they had attended. * * *

waiting for the return of these blanks from the physicians, the records of the ard of health were consulted. As fast as the returns were received from the ns, each house where a case of typhoid fever had occurred was visited by an r, who examined the surroundings, checked up the data recorded upon the nd obtained as many additional data as possible. He also secured the name of on furnishing the information, in case it became necessary to call witnesses in d finally signed the completed record. Duplicate copies of the blanks were th carbon paper and one of each placed in a safe to guard against possible loss. lts were then tabulated for study and in some instances expressed graphically. were also collected regarding the previous history of typhoid fever in the city. data were obtained from Fairfield, Winslow, and Benton.

typhoid fever in Waterville, Fairfield, Winslow, and Benton, January 1, 1902, to August 1, 1903.

Month.	Waterville.	Fairfield.	Winslow.	Benton.	Total.
1902.					
	2				2
	1	1			2
	4				4
	3				3
	3				3
	4		1		5
	13	1	1		15
	12	1	2	1	16
r	10	1	1		12
	7	3	1		11
r	20	5	2		27
	64	6	14	1	85
1903.					
	89	25	10	1	125
	23	8	7		38
	11	3			14
	5	1	1		7
		1	1		2
al	271	56	41	3	371

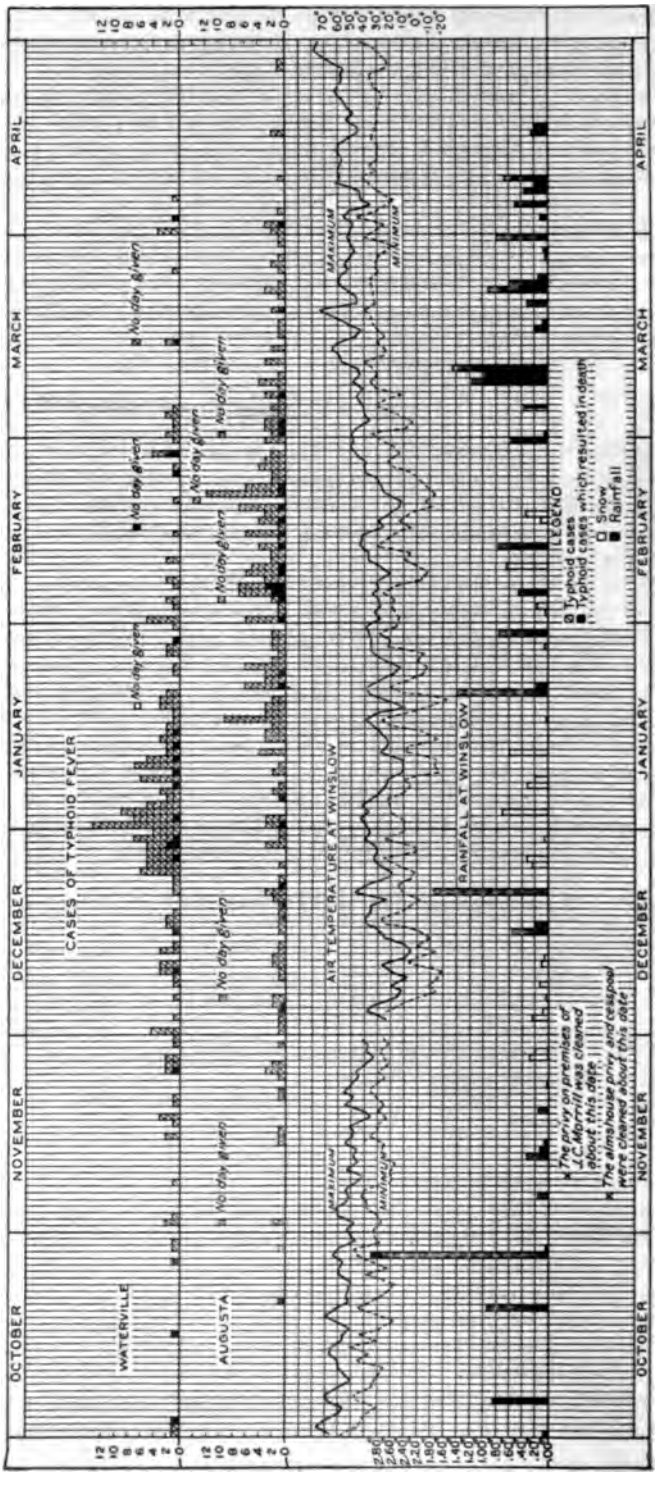


FIG. 15.—Diagram showing chronological distribution of typhoid-fever cases in Waterville and Augusta from October, 1902, to April, 1903.

yphoid canvass was followed by a complete house-to-house canvass through- places above mentioned, primarily in order to secure data in regard to the but also to obtain information as to the distribution of typhoid fever among :rent classes of waters. This not only accomplished its immediate object, to light a number of additional cases of typhoid fever which the physicians o report, some of which might be classed as "walking cases." No case, is included in the final compilation until it had the indorsement of the ıysician.

house-to-house canvass in Waterville, Me., with reference to the character of the water supplies and the number of cases of typhoid fever.

Water supply at residence.	Number of persons.	Number of typhoid cases.	Morbidity rate per 1,000.
o	6,537	226	34.57
er Co. and no other supply	3,225	132	40.93
er Co. and well water	866	23	26.57
er Co. and spring water	2,424	71	29.29
er Co. and cistern water	2	0	0.00
er Co., spring water, and well water	20	0	0.00
er Co. and well, spring, or cistern water	3,312	94	28.38
than Maine Water Co	1,459	21	14.41
only	1,286	19	14.77
and spring water	25	1	40.00
and cistern water	13	0	0.00
er only	108	1	9.26
er and cistern water	23	0	0.00
ter only	4	0	0.00
	7,996	247	30.89

a house-to-house canvass in the Kennebec water district with reference to the ter of the water supplies and the number of cases of typhoid fever.

	Supply from Maine Water Co.			No supply from Maine Water Co.			Total.		
	Number of persons.	Number of typhoid cases.	Morbidity rate per 1,000.	Number of persons.	Number of typhoid cases.	Morbidity rate per 1,000.	Number of persons.	Number of typhoid cases.	Morbidity rate per 1,000.
	6,537	226	34.57	1,459	21	14.41	7,996	247	30.89
	1,614	54	33.45	468	2	4.25	2,082	56	26.89
	244	11	45.08	902	19	21.06	1,146	30	26.18
				a 470	a 4	a 8.29			
	152	2	13.15	125	1	8.00	277	3	10.83
	8,547	293	34.28	2,954	43	14.55	11,501	336	29.21
						a 8.74			

a Omitting users of Kennebec River water.

ıecessary to relate in detail all the steps that were taken. Studying the he epidemic by the method of elimination, all possible causes other than vater supply were readily excluded. It could not have been caused by e at the season of the year when the epidemic started there were no flies. uded, because during the winter practically no ice was being used. Oys- minated, because very few of them were consumed in the city, and because part of the epidemic occurred among the French-Canadian laboring people, purchased them. Furthermore, the extended territory covered by the is in itself sufficient to exclude the above agencies. Milk was excluded as use, because the data collected indicated that the cases of typhoid fever ıcentrated among the customers of one or a few milkmen, but were well dis- ong the dealers. The distribution was found to be roughly proportional

to the size of the business and the number of cows kept. It was a singular fact t there was no case of typhoid fever among the customers of J. W. Morrill, in whose fam one of the initial cases of the epidemic occurred.

Vended spring waters were excluded, because the users of this class of water suffe far less than others, because the spring waters gave excellent analyses, and beca the water from no single spring or group of springs was used over the entire territ affected. The local wells were studied by us to some extent and quite extensiv by Mr. Caird. Many were found to be polluted, as would be naturally expected fr

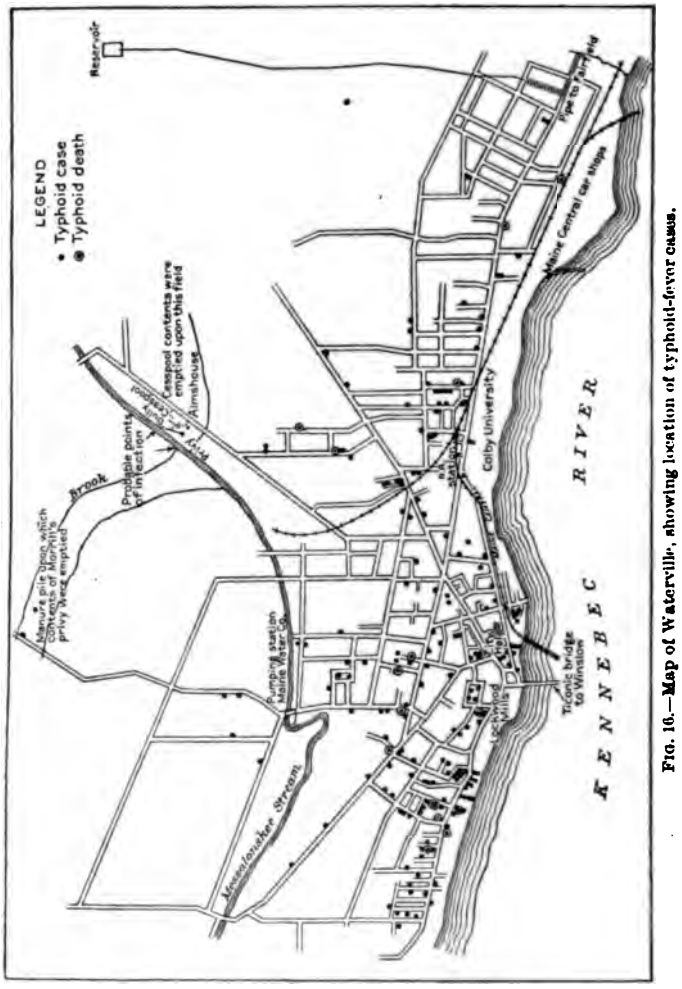


FIG. 16.—Map of Waterville, showing location of typhoid-fever cases.

the local conditions, but there was no evidence by which infection could be traced any one of them.

Practically the only cause left for serious consideration was the public water sup of the city, the cause to which everything had directly pointed from the start. T general distribution of the cases over an extensive territory (the various parts of wh had in common no possible causative factor other than the water supply), as shown fig. 16, the chronological sequence of the cases, the fact that in practically ev instance the patients gave a history of having regularly or occasionally drunk

ter in question, the data obtained as to the relative prevalence of typhoid fever ong users and nonusers of this water throughout the district, and, lastly, the dis-very of the actual means by which the water had in all likelihood become infected— l these things indicated with as much positiveness as is possible with circumstantial ridence that it was the public water supply which was the general distributing agent the infection.

For some time prior to the epidemic the character of the water supply of the city ad been such as to lead to a quite general use of spring water, which was peddled by everal dealers and purchased by most of those who could afford it. Well and cistern aters were used to a considerable extent. The water of the Kennebec River was sed at a number of the mills and in some residences, especially in Winslow. * * * he morbidity rate for the epidemic period among those who used Messalonskee water xclusively was 42.00 per 1,000, while among those who used Messalonskee and some ther water it was 14.55. If from the latter class there were excluded those who used ater from the Kennebec River, which at Waterville is more or less polluted, the orbidity rate was found to be only 8.74. It is not to be expected that even in this roup there would not be some who had occasionally used water from the Messalonskee pply, for, as a matter of fact, there were only five of the Waterville typhoid patients ho did not remember to have used this water at any time before being taken ill.

The figures given show emphatically that the morbidity rate was highest among ose who used the Messalonskee water exclusively and lowest among those who did ot use it. It must be remembered, of course, that in any epidemic there are always me cases contracted by direct infection from other cases.

In Fairfield many of the houses were supplied by water piped from a spring by a ivate company. Not a single case developed among the takers of this water.

ORIGIN OF THE EPIDEMIC IN WATERVILLE.

As soon as it had become evident, not only from the exclusion of other possible uses but from certain well-marked positive features of the situation, that the epi-mic was due to drinking water, a search for the actual origin of the infection of the blic water supply was begun. Our attention naturally was first directed to Oak-nd, as this was the only settlement of considerable size on the Messalonskee River ove Waterville. Inquiry among the Oakland physicians elicited the information at there had been but one case of typhoid fever there during the preceding summer d fall up to the beginning of the Waterville epidemic. This case had been imported om Winslow. An inspection of the premises where the patient resided convinced that this could not possibly have been the starting point of the Waterville epidemic.

Very soon after the returns from the typhoid canvass began to come in, two possible urces of infection of the city water supply suggested themselves, and further inves-ation of these rendered it reasonably certain that each of them had offered abundant portunity for the infection of the Messalonskee River.

The first of these foci was at the city almshouse, located in the suburbs of Waterville ar the Messalonskee Stream, as shown in fig. 16. A typhoid-fever patient, Joe ng, was admitted there on September 22, 1902. His attack was a mild one and fined him to bed for only a week. After leaving his bed, however, he remained e days longer at the almshouse, and during this latter period no attempt was made lisinfect either excreta or urine, which were deposited sometimes in a privy in the d and sometimes in a water-closet which drained into a cesspool on the premises.

November 6, 1902, the privy and cesspool were cleaned and their contents spread on the almshouse garden, the ground being frozen at the time. This was only a hundred feet from the Messalonskee River, into which it drained. The slope of intervening land was quite steep, and there was also a distinct gully which showed ry sign of carrying a considerable and rapid flow of water across the garden and into river after heavy rainfalls

The second focus of infection was found about a mile outside of Waterville, on the other side of the stream. During 1902 there had been five cases of typhoid fever in the families of J. W. Morrill and J. C. Morrill, who lived in farmhouses situated just across the road from each other. In all of these cases except one a prompt diagnosis had been made and the fecal dejecta of the patients had been disinfected and buried daily. In the second case of the series, however, the patient, Mrs. Studley, had been ill several weeks before the diagnosis of typhoid fever was made. During this time—i. e., from September 1 to September 25—no sufficient disinfection of stools was practiced, but they were emptied directly into a privy vault. Later on, at some time early in November, the contents of the privy were deposited in a field at a point where the land sloped abruptly toward a rivulet, about 200 feet away. After flowing about three-quarters of a mile over a very rapid course this brook emptied into the Messalonskee River almost directly opposite the almshouse above mentioned, about 1 mile upstream from the intake of the waterworks.

Thus, early in November, 1902, there were typhoid dejecta deposited upon the surface of the frozen ground at two points above and relatively near the pumping station of the Maine Water Company. In each case there was a sharp slope from the point where the dejecta were deposited—to the Messalonskee River in the one case and in the other to a small rill which emptied into the river. If these were the sources of infection, one would expect that from this time on the occurrence of typhoid fever among users of the Messalonskee water would bear an intimate relation to the rainfall. This relation was found to exist.

Fig. 15 shows the date of occurrence of the typhoid-fever cases, as determined by the date of physician's first visit—which was found to be in most cases the day when the patient took to bed—in Waterville, Fairfield, Winslow, and Benton, during the months of November, 1902, to February, 1903. The daily rainfall as recorded at Winslow is also shown. From this table it seems that during the early part of November there was only what may be considered a normal number of typhoid cases for this season. The first rainfall of considerable extent after infectious material was deposited in the fields was on November 12, when there was 0.30 inch. This was followed by a small group of cases toward the end of the month. The precipitation between November 23 and December 16 was snow, and this, gradually melting, probably washed small amounts of infectious matter into the river, which gave rise to the cases which developed up to about December 24. On the 16th day of December there was a precipitation of 0.56 inch, rain and snow, and nine days later, December 25, the real epidemic may be said to have begun, with the development of 6 cases of typhoid in Waterville and 1 in Fairfield. From December 25 to the end of the month there were 37 cases in Waterville, 5 in Winslow, 3 in Fairfield, and 1 in Benton, a total of 46 cases in one week.

The heaviest rainfall after the infectious material was deposited on the fields at Morrill's and the almshouse occurred on December 22, 1902, when there was a precipitation of 1.73 inches. Ten days after this, or almost exactly the same interval as after the rainfall of December 16, there developed the greatest number of cases of any day during the epidemic—namely, 13 cases in Waterville, 4 in Fairfield, and 1 in Winslow, a total of 18 cases.

Throughout the two months from the last third of November until the corresponding time in January, the relation between the rainfall and the typhoid cases was manifest, as shown in fig. 15. By the middle of January the typhoid bacilli in the two mentioned fields had either lost their vitality, or, what is more likely, had been pretty thoroughly washed away; for a rainfall of 1.40 inches on January 21 was not followed by any serious consequences. The constant relation between rainfall and the development of typhoid-fever cases was in itself a strong argument in favor of the agency of the public water supply in causing the epidemic.

n attempting to prove the case in court there were produced as witnesses the phyan who attended the initial cases, the persons who spread the cesspool and privy tents on the fields, the inspector who had charge of the typhoid canvass, and the ters who collected the data and made the various investigations here referred to. Although it is impossible in a paper of this length to give details of every piece of dence presented, it may be well to take notice of a plausible objection to the above ory which might have been brought forward. During the early part of the epinic Fairfield did not have as many cases in proportion to its population as did terville and Winslow, although supplied to a great extent by the same water. This s readily explained by a consideration of certain features of the distributing sysn. The reservoir of the system is located between Waterville and Fairfield and is plied by a single pipe line, which branches off from the main connecting the two ies. From this arrangement it follows that when the consumption in Waterville d Winslow is less than is being pumped, both places receive water directly from the mps, the excess going to the reservoir. When, on the other hand, the consumption greater than the amount pumped, Fairfield and Benton receive water which has en stored in the reservoir. This fact was proved experimentally during our investations by making several series of analyses at various points in the system. The ler water in the reservoir, which had received some sedimentation, would be theoically less infected with typhoid bacilli than the water pumped directly from the er; and theory, in these cases, certainly agreed with the facts. The facts also indied that the use of the Kennebec River water at the time of the Colby University could not have been the cause of the epidemic or have materially contributed to it. From the standpoint of the appraisal, the point to be established was not that the cases mentioned were or were not the cause of the epidemic, but that the public ter supply was or was not responsible for it. All the studies were incident to this in proposition.

TYPHOID FEVER IN AUGUSTA.

The methods used in studying the epidemic in Augusta were similar to those ployed at Waterville. The house-to-house canvass was perhaps more thorough, t on the other hand it was made several months after the epidemic was over, when facts were not so fresh in the minds of the people. The studies of the previous tory of typhoid fever in Augusta were much more important than in the Waterle case, and th problem was much more complicated because the city had two irces of public water supply and the number of spring waters sold was greater.

PREVIOUS HISTORY OF TYPHOID FEVER IN AUGUSTA.

The Kennebec River water was introduced as a source of public water supply in the ar 1887. For sixteen years before that time the average typhoid-fever death rate Augusta had been 36.5 per 100,000; for sixteen years from 1888 to 1903 the average e was 85.4. In 1898 there were a number of imported cases due to the Spanish r, and in 1903 occurred the great epidemic, which raised the death rate to 259 per 0,000. Excluding these two years, the average death rate during the period cover- the use of the Kennebec River water was 66.5, or nearly double what it formerly d been.

At various times prior to 1903 typhoid fever had been prevalent in the city. Thus board of health records for 1890 show that 75 cases of typhoid fever, besides a large ount of winter cholera, occurred that year. During the first thirteen weeks of 1891 cases were reported. There were no typhoid-fever records kept at Waterville at s time, so it can not be told whether or not the disease was due to infected sewage m that city. Typhoid fever was also prevalent during the winter and spring of 1892

and 1893. A report made by Capt. M. W. Wood, assistant surgeon, U. S. Army, o June 2, 1893, states that there were about 100 cases during the early part of that yea

Prior to the introduction of the Kennebec River water, typhoid fever in Augusta ha been most common in the autumn, this being the normal season for the maximum o the disease, but after the installation of the supply from the Kennebec River the dis ease became most common during the winter months. This is an abnormal seasona

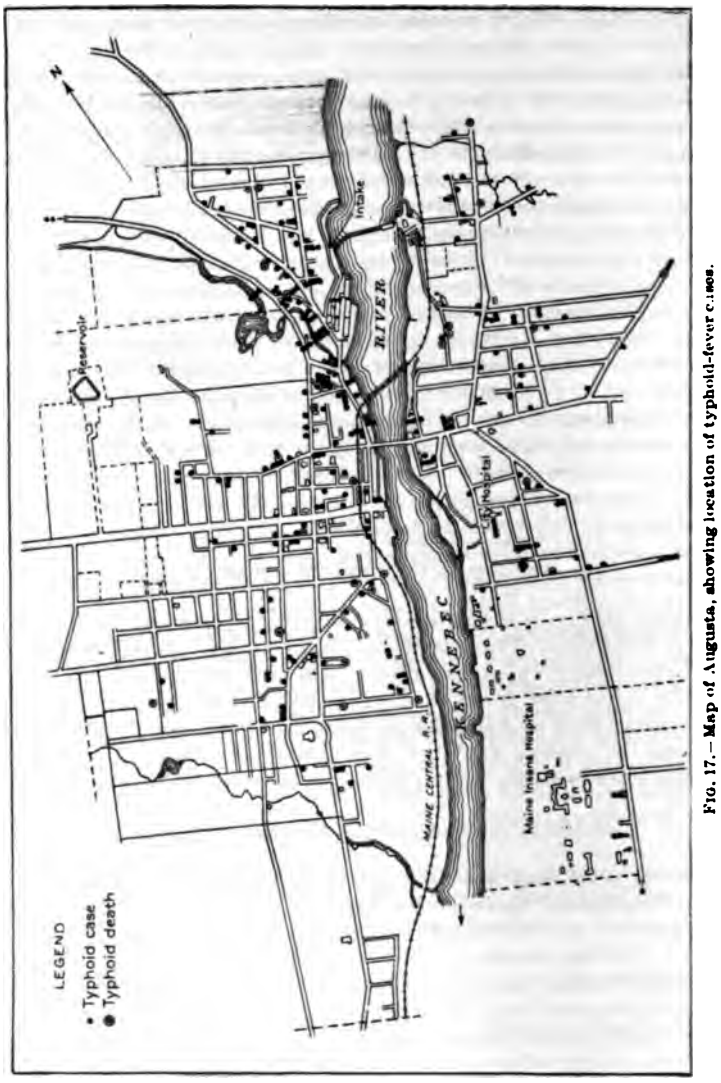


FIG. 17.—Map of Augusta, showing location of typhoid-fever cases.

distribution, and is most easily explained by assuming the maximum of the disease Augusta to follow and to be caused by the normal autumnal maximum of typhoid fev in Waterville and the other cities which discharge their sewage into the river abo Augusta.

Both the abundance of typhoid fever and its seasonal distribution since 1888 point strongly to the pollution and infection of the river water and would have been su

ondemn it as a source of supply even if the epidemic of 1902–3 had not
* * *

ıe case of Waterville, all possible agencies of infection other than water were
ne excluded from consideration. The canvass showed that the morbidity
ıose cases on premises supplied with river water only was 53.7 per 1,000; on
plied only with Devine water, 12.3; and on those supplied by wells, springs,
, 23.6. On those premises supplied with river water with or without supple-
ources the morbidity rate was 29.2, while on those which had no river water
vas 20.6.

ing the cases according to the statements of the patients as to their use of
vas found that of 336 cases 76 per cent admitted that they had used the river
or to being taken sick, while 24 per cent of them did not remember to have
water. Of the latter class, however, 65 per cent lived on premises supplied
r from the river. Thus only about 8 per cent of the patients interviewed did
nber of having used the water and were not supplied with water from the
heir homes. The conclusion that the river water caused the epidemic was
. * * *

Population and typhoid fever at Augusta, Me., 1865 to 1903.

[From records in the city clerk's office.]

Year.	Estimated population.	Deaths.		Death rate per 100,000.		Typhoid per cent of total deaths.
		Total.	Typhoid.	Total.	Typhoid.	
	7,650	90	12	1,176.0	156.9	13.3
	7,675	26	1	338.8	130	3.9
	7,700	3		39.0		
	7,750	1		12.9		
	7,800	50	3	641.0	38.5	6.0
	7,808	99	4	1,268	51.2	4.1
	7,875	90	2	1,143	25.4	2.2
	7,925	95	6	1,198	75.7	6.3
	8,000	138	4	1,725	50.0	2.9
	8,075	80		991		
	8,150	90		1,104		
	8,225	131	6	1,584	73.0	4.6
	8,300	125	6	1,505	72.3	4.8
	8,425	128	6	1,520	71.2	4.7
	8,550	101	1	1,182	11.7	0.99
	8,665	115		1,327		
	8,825	131	4	1,485	45.3	3.1
	9,000	102	1	1,134	11.1	0.98
	9,175	127	2	1,384	21.8	1.6
	9,400	80		851		
	9,575	100	1	1,044	10.4	1.0
	9,775	143	6	1,462	61.4	4.2
	9,975	170	8	1,704	80.2	4.7
	10,175	151	4	1,484	39.3	2.7
	10,350	139	2	1,343	19.3	1.4
	10,527	182	16	1,729	152	8.8
	10,675	34	5	318	46.9	14.7
	10,825	315	7	2,910	64.7	2.2
	10,950	304	9	2,776	82.2	3.0
	11,075	322	6	2,906	54.2	1.9
	11,200	322	7	2,874	62.5	2.2
	11,325	316	11	2,790	97.1	3.5
	11,425	323	7	2,825	61.2	2.2
	11,525	257	20	2,230	173.5	7.8
	11,625	318	9	2,734	77.4	2.8
	11,683	289	4	2,472	34.2	1.4
	11,800	312	11	2,644	93.2	3.5
	11,875	304	6	2,560	50.3	2.0
	11,975	297	31	2,480	25.9	10.4

Chronological table of typhoid cases and deaths in Augusta, Me., between October, 1902, and May 1, 1903.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1			1	3	5+*1*	1+*1*+(1)	2
2		2+(1)	1	2+*1*	1	2+*1*	2+1
3			1	3	1	2+*1*	
4			1		1+*1*+(1)	1	1
5			1+*1*	*1*	5+*2*	2	
6			2+(1)	2	4+*3*	1	
7				1	3	2+*1*	
8					5+*1*	1	
9			1	2	4+*1*	4	1
10			1	1	2	1	
11			2		2		
12			2	4	3+*1*	3	
13			1		1		
14		1	1	3	5+*1*	2	
15		1		3	1		
16		1	1	2	3+*1*	1	
17			1	6+*3*	3	1	2
18			*1*	3	6+*1*	1	
19			1	3	(1)		
20			1	2	11+*1*	1+*1*	
21	*1*	1	2		5+*1*		
22		1	3	5+*1*	2	1	
23			*1*	3	2	3	
24		1	1	2+*1*	4	1	
25		3		6	3		
26		2	1	2	2	1	
27				1		2	1
28				2	3	1	
29	1	*1*	3	2			
30			1	2		1	
31			1			1	
	1+*1*	14+*1*	32+*3*	65+7	89+*15*	38+*5*	10+1

Total for epidemic of 1902–3, 280. Numbers in italic indicate deaths. Numbers in parentheses indicate that date of case is uncertain.

Seasonal distribution of typhoid fever in Augusta.

BEFORE INTRODUCTION OF KENNEBEC RIVER WATER, 1865–1887.[a]

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Average typhoid deaths	2	0	4	1	3	4	5	10	11	23	6	4
Average typhoid death rate per 100,000	1.06	0	2.12	0.53	1.59	2.12	2.65	5.30	5.83	12.21	3.18	2.12

AFTER INTRODUCTION OF KENNEBEC RIVER WATER, 1888–1903.[b]

Average typhoid deaths	15	25	28	15	6	4	4	1	15	13	9	20
Average typhoid death rate per 100,000	8.32	13.80	15.50	8.87	3.33	2.20	2.20	0.55	8.32	7.18	4.98	11.07

[a] Average population, 8,200.

[b] Average population, 11,300.

Distribution of typhoid fever in Augusta according to water service.

JANUARY 1, 1902, TO JANUARY 1, 1904.

Water supply used.	Number of persons.	Typhoid cases.	Typhoid deaths.	Morbidity per 100,000.
only	2,980	160	16	5,370
e only	408	5	1	1,226
springs, and cisterns	1,441	34	5	2,359
and Devine	295	7	2	2,373
and wells, springs, and cisterns	3,671	105	6	2,860
e and springs or cisterns	39	0	0	0
ssified	12	0	0	0
	8,846	311	30	3,516

DURING THE EPIDEMIC, NOVEMBER 1, 1902, TO MAY 1, 1903.

only	2,980	134	15	4,500
e only	408	3	1	735
springs, and cisterns	1,441	28	5	1,940
and Devine	295	7	2	2,373
and wells, springs, and cisterns	3,671	88	6	2,400
e and springs or cisterns	39	0	0	0
ssified	12	0	0	0
	8,846	260	29	2,940

TYPHOID FEVER AT RICHMOND.

e typhoid-fever records of Richmond do not extend back of 1892. The city 's records for the years 1892 to 1903, however, indicate a death rate of 42 per 00 during these twelve years.

e typhoid-fever canvass of Richmond was less complete than that of Augusta; f the 19 cases which occurred between January and April, 1903, all were said ve used the river water, and there is little reason to believe that these cases due to any other cause.

DEATHS FROM TYPHOID IN KENNEBEC VALLEY, 1892-1903.

ıe following table gives the population and typhoid statistics of ›rincipal towns in the Kennebec basin from 1892 to 1903, inclusive:

Deaths from typhoid fever in principal towns in Kennebec Valley, 1892–1903.

Town.	Population (U.S. census).		Deaths from typhoid fever.													
	1890.	1900.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	Total, 1892–1902.	Average per 100,000 1892–1902.	1903.
›n	1,815	2,764	1	1	1	0	0	0	0	0	1	1	0	5	21	1
egan	5,068	5,180	2	1	1	2	0	0	0	1	0	0	0	7	12	1
id	3,510	3,878	0	2	1	0	0	2	0	1	0	1	1	8	19	6
id	2,044	1,913	2	0	1	0	0	2	1	0	0	2	0	8	37	.....
›rt	1,188	1,533	0	0	2	0	0	1	0	0	1	0	0	4	26	1
eld	2,503	2,891	0	0	1	3	2	0	2	3	1	1	1	14	48	1
ville	7,107	9,477	2	3	3	1	0	3	2	3	2	7	7	33	35	18
ta	10,527	11,683	9	7	6	5	5	5	19	8	4	9	4	81	66	31
vell	3,181	2,714	0	1	2	1	2	1	1	0	0	4	2	14	45	1
ıer	5,491	5,501	0	2	0	0	1	2	2	2	1	2	1	13	22	1
ond	3,062	2,049	1	0	2	0	0	0	1	0	2	1	1	8	28	2

GAZETTEER OF RIVERS, LAKES, AND PONDS IN KENNEBEC BASIN.

By B. D. Wood.

This list of rivers, lakes, and ponds in the Kennebec drainage basin is based principally on data in the following reports:

Wells, Walter, The Water Power of Maine, 1869.

Swain, G. F., Tenth Census, vol. 16, pt. 1, 1885, pp. 83–89.

Pressey, H. A., Water Powers of the State of Maine: Water-Sup. and Irr. Paper No. 69, U. S. Geological Survey, 1902.

The best maps available have been consulted, including the topographic sheets of the United States Geological Survey, Hubbard's Map of Northern Maine, and Scarborough's Map of Southeastern Maine. (See fig. 1, p. 3.) All areas quoted from Wells are so marked; others are based on either the topographic sheets or surveys of the Geological Survey, as explained on page 14. Elevations above mean sea level are also from these last two sources.

Abagadassett River; rises in Gardiner Township, Kennebec County; flows southward into Kennebec River at Merrymeeting Bay; tidal in lower part of course.

Alder Pond; Tps. 2 and 3, R. 5, west-central Somerset County; outlet into Dead River.

Alder Stream; rises in Butler Pond, Lexington Township, Somerset County; flows southeastward into Gilman Pond, which discharges into Carrabassett River.

Alder Stream; rises in a small pond in East Moxie Township, eastern Somerset County; flows southwestward into Moxie Pond.

Alder Stream; rises in Alder Stream Mountain, in T. 3, R. 4, northern Franklin County; flows northeastward into North Branch of Dead River in the western part of Jim Pond Township.

Annabessacook Lake; Winthrop and Monmouth townships, Kennebec County; inlets from Lake Maranacook and Narrows and Wilsons ponds; outlet into Cobbosseecontee Pond; area 2.2 square miles; elevation, 174 feet. Called by Wells "South Pond."

Attean Pond; Attean Township, west-central Somerset County; inlet, Moose River; outlet, Moose River; area about 4.5 square miles; elevation, 1,158 feet. See pages 135–136 for further information regarding this pond.

Austin Ponds; Bald Mountain and Mayfield townships, Somerset County; outlet, Austin Stream; elevation of largest pond, 1,188 feet; five ponds, with a total water surface of approximately 3.2 square miles (Wells).

Austin Stream; rises in Austin Pond, in Bald Mountain Township, eastern Somerset County; flows southwestward, uniting with Kennebec River at Bingham; flows

ugh Austin Ponds near headwaters; about 3.5 miles from its source it receives th Branch; the stream receives also a number of other brooks draining small ponds.

aker Brook; rises in Tomhegan Township, eastern Somerset County; flows southward into Moosehead Lake.

aker Pond; T. 5, R. 6, western Somerset County; outlet into Spencer Stream.

aker Pond; Spaulding Township, eastern Somerset County; outlet, Baker Stream; ives drainage from Dimmick Ponds; elevation, 1,066 feet.

aker Stream; rises in Baker Pond, Spaulding Township, eastern Somerset nty; flows northward into Moxie Pond.

arker Pond; Cornville Township, Somerset County; outlet into Moose Pond (to asticook River); area, 0.35 square mile (Wells).

arnard Pond; Eustis Township, northeastern Franklin County; outlet into Tim ok.

arrett Brook; rises in a small lake in Holeb Township, western Somerset County; rs northeastward into Moose River.

artlett Pond; T. 4, R. 5, western Somerset County; outlet into Spencer Stream.

assett Brook; rises in northern part of Moscow Township, Somerset County; rs southward and southwestward into Chase Stream.

ean Brook; rises in western part of Forks Plantation, Somerset County; flows thwestward into Kennebec River.

eans Pond; eastern Pleasant Ridge Township, Somerset County; outlet into we Pond; elevation, about 1,240 feet.

ear Brook; rises in northern part of Franklin County; flows southward, entering th Branch of Dead River just above Natanis Pond.

ear Pond; Kibby and Alder Stream townships, northern Franklin County; outinto North Branch of Dead River.

eaver Brook; rises in Moores Pond, T. 4, R. 7, west-central Somerset County; rs northward into Horse Brook, a tributary of Moose River.

eaverdam Brook; rises in a small pond in New Sharon Township, Franklin nty; flows southwestward into Sandy River.

eaver Pond; Rome Township, Kennebec County; inlet from Kidder Pond; outto Long Pond (to Messalonskee Lake); elevation, about 440 feet.

elgrade Stream; rises in Long Pond, in western Belgrade Township, Kennebec nty; flows southeastward, then northeastward, into Messalonskee Lake.

enjamin Ponds (3); Attean Township, west-central Somerset County; outlet to tle Wood Pond (to Moose River).

erry Pond; Wayne Township, Kennebec County; outlet into Dexter Pond (to sons Pond).

ig Indian Pond; western Piscataquis County; outlet through Indian Stream to lian Pond, Kennebec River; area, 0.4 square mile.

itter Brook; rises in small ponds in T. 3, R. 6, western Somerset County; flows thward into lake at head of Enchanted Stream.

lack Brook; rises on Mount Pisgah, central Franklin County; flows northwestd into South Branch of Dead River.

lack Brook Pond; T. 1, R. 5, eastern Somerset County; outlet to Kennebec ver; area, 0.5 square mile.

lack Stream; rises in southeastern part of Cornville Township, Somerset County; rs southeastward into Sebleys Pond (to Carrabassett Stream).

lanchard Pond; Alder Stream Township, northern Franklin County; outlet into th Branch of Dead River.

log Brook; rises in Jerusalem Township, Franklin County; flows northward into d River.

log Pond; T. 2, R. 6, northern Franklin County; inlet from Long Pond (Dead ver); outlet to Lower Pond; elevation, 1,260 feet; one of the "Chain of Ponds."

Bog Stream: rises in northwestern part of Rome Township, Kennebec County; flows northward into Sandy River.

Bombazee Brook: rises in western part of Norridgewock Township, Somerset County; flows northeastward into Kennebec River.

Bond Brook: rises in eastern part of Manchester Township, Kennebec County; flows southeastward into Kennebec River at Augusta.

Boynton Pond: Embden Township, Somerset County; outlet into Fahi Pond.

Bradley Pond: Topsham Township, Sagadahoc County; outlet into Cathance River; elevation, about 100 feet.

Brandy Pond: northern part of Pleasant Ridge Township, Somerset County; outlet into Rowe Ponds (to Carrabassett River).

Brassua Lake: eastern Somerset County; inlets, Brassua Stream, Moose River, and Miseree Stream; outlet, Moose River; area 5.55 square miles; elevation, 1,043 feet. See page 133 for additional information regarding this pond.

Brassua Stream: rises in Luther Pond, Thorndike Township, central Somerset County; flows eastward and southward into Brassua Lake (to Moose River).

Buker Pond: Litchfield Township, Kennebec County; inlet from Jimmy Pond; outlet to Sand Pond (to Cobbosseecontee Stream); elevation, about 175 feet.

Burnham Pond: western Piscataquis County; outlet to Indian Pond (to Kennebec River).

Butler Ponds: Flagstaff Township, western Somerset County; outlet into Flagstaff Lake.

Butler Pond: Lexington Township, Somerset County; outlet through Alder Stream and Gilman Pond to Carrabassett River; area, 0.4 square mile (Wells).

Carlton Pond; Readfield and Winthrop townships, Kennebec County; outlet to Narrows Pond (to Lake Annabessacook); area, 0.5 square mile; elevation, about 320 feet.

Carney Brook; rises in Decker Ponds, Carritunk Township, Somerset County; flows southward into Kennebec River.

Carrabassett River: rises in Crocker Township, eastern Franklin County; flows northward, eastward, and then southeastward about 45 miles, entering Kennebec River at North Anson; drainage area, 395 square miles; no large tributaries; few lakes and ponds; considerable fall, used to some extent for power. Gaging station near North Anson established in 1901; drainage area at this point, 340 square miles.

Carrabassett Stream: rises in Sebleys Pond, Canaan Township, Somerset County; flows southwestward into Kennebec River about 10 miles above Waterville.

Carry Brook; rises in Plymouth or Boyd Township, eastern Somerset County; flows southeastward into Moosehead Lake.

Carrying Place Ponds; central part of Somerset County; a group of eight ponds, three of which are of considerable size; the easternmost pond—area (Wells) about 1 square mile—has outlet to Kennebec River; the westernmost (area 1.3 square miles) to Dead River, elevation 1,250 feet (barometric); and the middle pond—area (Wells) about 0.3 square mile—through Rowe Ponds to Carrabassett River; three small ponds are connected with the middle pond and one drains to the western pond; one pond, probably the smallest of the group, is connected with the outlet stream of the middle pond. West Carry Pond has a dam giving a head of about 10 feet; used for storage of water for log driving. See page 140 for further information regarding West Carry Pond.

Cathance River; rises in northwestern part of Bowdoin Township, Sagadahoc County; flows, with abrupt turns, to the south, east, northeast, and then southeast and south into Kennebec River at Merrymeeting Bay.

Chain of Ponds; northern Franklin County; outlet into North Branch of Dead River; includes three large ponds and several smaller ones; area, three ponds (Natanis, Long, and Lower), approximately 5 square miles (Wells); elevation, 1,260 feet.

Chase Bog Pond; southwestern Spaulding Township, Somerset County; outlet to Chase Pond; elevation, about 1,480 feet.

Chase Pond; western part of Jim Pond Township, northeastern Franklin County; outlet to North Branch of Dead River.

Chase Ponds; northern part of Moscow Township, Somerset County; outlet into Austin Stream; elevation of largest pond, 1,356 feet.

Chase Stream; rises in Chase Pond, Moscow Township, Somerset County; flows southward into Austin Stream.

Chase Stream; rises in Chase Stream Pond, on the south boundary of Misery Township, eastern Somerset County; flows southeastward into Kennebec River.

Chase Stream Pond; south boundary of Misery Township, eastern Somerset County; outlet through Chase Stream to Kennebec River; area, approximately, 0.6 square mile (Wells).

Chesterville Ponds; Chesterville Township, Franklin County; outlet into Sandy River; area, total of six small ponds, 2 square miles (Wells).

China Lake; Vassalboro and China townships, Kennebec County; outlet into Sebasticook River; area, 6.1 square miles; elevation, 195 feet; used as source of municipal water supply for Waterville.

Churchill Stream; rises in a small lake in Misery Township, eastern Somerset County; flows northeastward into West Outlet of Moosehead Lake.

Clearwater Brook; rises in T. 2, R. 6, northern Franklin County; flows southwestward into Long Pond (to Dead River).

Clear Water Pond; Industry and Farmington townships, Franklin County; outlet into Sandy River; area, approximately, 1.75 square miles (Wells).

Cobbosseecontee Pond; Winthrop, Monmouth, Manchester, and West Gardiner townships, Kennebec County; inlets from Purgatory Ponds, Lake Annabessacook, and Richard Pond; outlet Cobbosseecontee River; area, 8.4 square miles; elevation, 171 feet; dam at outlet; used for storage of water for power.

Cobbosseecontee Stream; drains a group of lakes aggregating 19 square miles in area, lying from 5 to 15 miles west of Augusta; from the largest of the lakes, Cobbosseecontee Pond, which has an area of 8.4 square miles, the river flows southward, eastward and then northeastward, entering Kennebec River at Gardiner; drainage area, 240 square miles; length from Cobbosseecontee Pond to Gardiner about 16 miles; river is extensively used for power and furnishes the municipal supply for the city of Gardiner; flow is very regular and furnishes one of the best examples of efficient storage in the country. Gaging station near Gardiner, maintained by Gardiner Water Power Company since 1890; drainage area at this point, 240 square miles.

Cochnewagon Pond; Monmouth Township, Kennebec County; outlet into Wilsons Pond (to Lake Annabessacook); area, about 1 square mile (Wells).

Cold Stream; rises in Cold Stream Pond, in Misery and Parlin Pond townships, central Somerset County; flows southwestward, then southeastward, into Kennebec River.

Cold Stream Pond; Misery and Parlin Pond townships, central Somerset County; outlet through Cold Stream into Kennebec River; area, approximately, 1.25 square miles (Wells).

Corinna Pond; Corinna Township, western Penobscot County; inlets from Dexter Pond; outlet into Sebasticook Lake; area, 0.6 square mile (Wells).

Dam Pond; Augusta Township, Kennebec County; outlet to Kennebec River through Sevenmile Brook; elevation, about 210 feet.

Dead River; formed by junction of North and South branches; North Branch rises in northern part of Franklin County and flows in a general southeasterly direction about 25 miles to Eustis, where it is joined by the South Branch; South Branch rises in mountains east of Rangeley Lakes and flows in a general northeasterly direction about 16 miles; from junction of two branches main stream flows eastward, northward,

and then eastward about 40 miles to its junction with Kennebec River at The Forks, 24 miles below Moosehead Lake; total drainage area, 870 square miles; tributaries of North and South branches of no importance; tributaries of main river are Flagstaff Lake outlet, Carry Ponds outlet, and Spencer Stream (the largest); basin mostly wild and forested; many lakes and ponds, the most important being Flagstaff and Spring lakes, Carry and Spencer ponds. Gaging station at The Forks established in 1901; drainage area at this point, 870 square miles.

Dead River Pond; southern part of Dallas Township, west-central Franklin County; inlet from Saddleback Ponds; outlet South Branch of Dead River.

Dead River Pond; T. 1, R. 5, eastern Somerset County; outlet into Kennebec River.

Decker Brook; rises in southeastern part of Carritunk Township, eastern Somerset County; flows southeastward and eastward into Kennebec River.

Decker Ponds; Carritunk Township, Somerset County; outlet through Carney Brook to Kennebec River; elevation, about 1,260 feet.

Deer Pond; T. 4, R. 5, northwestern Somerset County; outlet to Flagstaff Lake (to Dead River).

Dexter Pond; Wayne Township, Kennebec County; outlet to Wilson Pond (to Lake Annabessacook); inlet from Berry Pond.

Dexter Ponds; Dexter Township, Penobscot County; outlet into Corinna Pond (to Sebasticook Lake); area, 3 square miles (Wells).

Dimmick Ponds (2); Spaulding Township, eastern Somerset County; inlet from Mountain Pond and several small brooks; outlet to Baker Pond; elevation of upper pond, about 1,460 feet; of lower pond, about 1,400 feet.

Double Head Pond; northern part of Litchfield Township, Kennebec County; one small inlet; outlet southward into Purgatory Pond; elevation, about 175 feet.

Doughnut Pond; eastern Carritunk Township, Somerset County; outlet into Robinson Pond; elevation, about 1,580 feet.

Dutton Pond; Kingfield Township, Franklin County; outlet into Carrabassett River.

East Brook; rises in Middle Carrying Place Pond, Somerset County; flows southward, uniting with Rowe Pond Stream to form Sandy Stream, a tributary of Carrabassett River.

Eastern River; rises in Pittston Township, southeastern Kennebec County; flows southwestward, entering Kennebec River in Dresden Township.

East Pond; Smithfield Township, Somerset County; outlet into North Pond (to Messalonskee Lake); area 2.6 square miles; elevation above sea, 260 feet.

Ellis Pond; T. 1, R. 6, eastern Somerset County; outlet into Kennebec River.

Ellis Pond; Belgrade and Oakland townships, Kennebec County; inlet from McGrath Pond; outlet to Great Pond; area, 0.9 square mile; elevation, 273 feet. Called by Wells "Richmond Pond."

Embden Pond; Embden Township, Somerset County; outlet through Mill Stream to Carrabassett River; area, 2.4 square miles; elevation, 422 feet.

Emerton Ponds; western Moscow Township, Somerset County; outlet into Kennebec River; elevation, about 500 feet.

Enchanted Stream; rises in T. 3, R. 6, western Somerset County; flows southeastward into Dead River.

Fahi Brook; rises in Fahi Pond, Embden Township, Somerset County; flows southward and southwestward into Mill Stream, a tributary of Carrabassett River.

Fahi Pond; Embden Township, Somerset County; outlet, Fahi Brook; area, 0.6 square mile (Wells); elevation, 413 feet.

Fall Brook; rises in southwestern part of Mayfield Township, Somerset County; flows southwestward and enters Kennebec River at Solon.

Fifteenmile Brook; rises in Lovejoy Pond, Albion Township, Kennebec County; flows northward into Sebasticook River.

Fish Pond; T. 1, R. 5, eastern Somerset County; outlet to Kennebec River.

Fish Pond; Thorndike Township, north-central Somerset County; outlet into Lower Churchill Stream.

Fitzgerald Pond; near Squaw Mountain, western Piscataquis County; outlet, Squaw Brook (to Moosehead Lake).

Flagstaff Lake; Flagstaff Township, western Somerset County; outlet to Dead River; area, 1.4 square miles; elevation, approximately, 1,100 feet (barometric); dam commands 12 feet head; used for storage of water for log driving. See pages 139–140 for additional information regarding this lake.

Gander Brook; rises in Dennes Township, west-central Somerset County; flows southeastward into Wood Pond (to Moose River).

Gardiner Pond; northwestern part of Wiscasset Township, Lincoln County; one small inlet; outlet stream flows northeastward through Gardiner Pond Swamp, thence northwestward and westward into Eastern River; elevation, 168 feet; area, 0.9 square mile. Called by Wells "Great Swamp in Dresden."

George Lake; Skowhegan and Canaan townships, Somerset County; outlet to Oak Pond and Carrabassett Stream.

Gilman Pond; Lexington and New Portland townships, Somerset County; outlet into Carrabassett River; inlets from several small ponds; area, 0.5 square mile (Wells).

Gold Brook; rises in Kibby Township, northern Franklin County; flows southwestward into North Branch of Dead River.

Great Pond; Rome and Belgrade townships, Kennebec County; inlets from North, Ellis, and McGrath ponds; outlet to Long Pond (to Messalonskee Lake); area, 12.7 square miles; elevation, 250 feet.

Greeley Pond; Augusta Township, Kennebec County; outlet to Togus River; elevation, about 160 feet.

Greeley Pond; Mount Vernon and Readfield townships, Kennebec County; outlet into Lake Maranacook; area, 1.1 square miles; elevation, 293 feet.

Greenbush Pond; Jim Pond Township, northern Franklin County; outlet to North Branch of Dead River.

Grindstone Pond; Kingfield Township, Franklin County; outlet to Tufts Pond.

Gulf Stream; rises in T. 1, R. 5, central Somerset County; flows southeastward into Dead River.

Gulf Stream; rises in Withee Pond, Mayfield Township, Somerset County; flows northwestward into Austin Stream.

Hall Pond; T. 5, R. 7, western Somerset County; outlet to Spencer Pond.

Hammond Brook; rises in Jerusalem Township, Franklin County; flows eastward into Carrabassett River.

Hancock Pond; Embden Township, Somerset County; outlet to Embden Pond; area, about 1 square mile (Wells); elevation, 520 feet.

Hayden Lake; Madison Township, Somerset County; outlet into Wesserunsett Stream; area, about 3 square miles (Wells). Called by Wells "Madison Pond."

Heald Pond; Moose River Plantation, western Somerset County; outlet to Moose River.

Heald Ponds (3); Spaulding Township, eastern Somerset County; outlet into Austin Stream; elevation of highest pond, 1,388 feet.

Heald Stream; rises in Heald Ponds, Spaulding Township, eastern Somerset County; flows southeastward into Austin Stream.

Henson Brook; rises in Jackman Township, western Somerset County; flows northward into Moose River.

Hicks Pond; Palmyra Township, Somerset County; outlet into Sebasticook Lake.

Higgins Stream; rises in Brighton Township, Somerset County; flows southeastward into Moose Pond (to Sebasticook River).

Holeb Pond; Holeb Township, western Somerset County; outlet into Moose River; area, approximately 2 square miles; elevation, about 1,133 feet. See pages 136-137 for further information regarding this pond.

Holway Brook; rises in southern part of Forks Plantation, Somerset County; flows southwestward into Kennebec River.

Horse Brook; rises in T. 3, R. 6, central Somerset County; flows northwestward into Moose River.

Horseshoe Pond; West Gardiner Township, Kennebec County; outlet into Cobbosseecontee River; elevation, 137 feet.

Horseshoe Pond; T. 2, R. 6, northern Franklin County; outlet into North Branch of Dead River; elevation, about 1,260 feet.

Horseshoe Pond; Tps. 3 and 4, R. 5, western Somerset County; outlet into Spencer Stream.

Houston Brook; rises in western part of Pleasant Ridge Township, Somerset County; flows southeastward, then northeastward, into Kennebec River.

Huston Brook; rises on southern slope of Mount Bigelow, western Somerset County; flows southward into Carrabassett River.

Indian Pond; Holeb Township, western Somerset County; outlet into Moose River.

Indian Pond; Lexington Township, Somerset County; outlet into Carrabassett River.

Indian Pond; St. Albans Township, Somerset County; outlet into Sebasticook River; area, approximately, 2.5 square miles (Wells).

Indian Pond; eastern Somerset County; inlets, West Outlet Ponds, Kennebec River, Indian Stream, and a number of small streams and ponds; outlet, Kennebec River; about 5 miles long in two levels, the first being about a mile long, and 932 feet above mean tide; a short stretch of "narrows," where a fall of about 5 feet occurs, connects the two levels; greater part of pond is 927 feet above tide; used for regulation of water in log driving; controlled by a dam at lower end; total area, 1.5 square miles.

Indian Stream; rises in Big Indian Pond, western Piscataquis County; flows northwestward into Indian Pond, Kennebec River.

Indian Stream; rises in the western part of T. 2, R. 6, northern Franklin County; flows eastward into Long Pond (to Dead River).

Ironbound Pond; Thorndike Township, north-central Somerset County; outlet into Lower Churchill Stream.

Iron Pond; T. 5, R. 6, western Somerset County; outlet into Spencer Stream.

Island Pond; T. 1, R. 6, eastern Somerset County; outlet into Kennebec River.

Jackson Brook; rises in southern part of Moscow Township, Somerset County; flows southwestward into Kennebec River.

Jackson Pond; Concord Township, Somerset County; outlet through Mill Stream to Martin Stream.

Jamies Pond; Manchester and Farmingdale townships, Kennebec County; outlet into Sanborn Pond (to Cobbosseecontee River); elevation, about 210 feet.

Jim Pond; northwestern Franklin County; outlet into North Branch of Dead River.

Jimmy Pond; Litchfield Township, Kennebec County; outlet into Buker Pond; elevation, about 175 feet.

Johnson Brook; rises in small ponds in northern part of Bingham Township, Somerset County; flows southward into Fall Brook, which enters the Kennebec.

Judkins Pond; Lexington Township, Somerset County; outlet through Gilman Pond to Carrabassett River; area, 0.75 square mile (Wells).

Kelly Brook; rises in central part of Forks Plantation, Somerset County; flows westward into Kennebec River.

Kibby Stream; rises in Kibby Township, northern Franklin County; flows southeastward into Spencer Stream, western Somerset County.

Kidder Pond; Vienna Township, Kennebec County; outlet into Beaver Pond; elevation, about 840 feet.

Knights Pond; Square Town Township, eastern Somerset County; outlet into Kennebec River; area, 0.2 square mile.

Lazy Tom Brook; rises in western Piscataquis County; flows southward into Roach River.

Lemon Stream; rises in Industry Township, Franklin County; flows southeastward into Sandy River.

Lily Pond; Freeman and New Portland townships, Franklin and Somerset counties; outlet into Carrabassett River.

Little Alder Stream; rises in extreme southern part of T. 2, R. 6, northern Franklin County; flows southeastward into Alder Stream, a tributary of North Branch of Dead River; receives drainage from Snow and Round Mountain ponds.

Little Austin Pond; Bald Mountain Township, eastern Somerset County; outlet into Austin Pond; elevation, 1,216 feet.

Little Big Wood Pond; Dennes Township, west-central Somerset County; inlet, Wood Stream; outlet into Little Wood Pond; area, approximately, 1.35 square miles (Wells).

Little Chase Pond; Moscow Township, Somerset County; outlet into Chase Stream; elevation, about 1,320 feet.

Little Heald Brook; rises on south side of Dimmick Mountain, Spaulding Township, eastern Somerset County; flows southeastward into Heald Stream.

Little Houston Brook; rises in western part of Concord Township, Somerset County; flows northeastward into Houston Brook.

Little Indian Pond; St. Albans Township, Somerset County; outlet into Indian Pond (to Sebasticook River); area, approximately, 0.35 square mile (Wells).

Little Indian Pond; Square Town Township, eastern Somerset County; outlet into Indian Stream (to Kennebec River).

Little Jim Pond; northeastern Franklin County, Jim Pond Township; outlet into Jim Pond.

Little Pocket Pond; T. 2, R. 6, northern Franklin County; outlet to Natanis Pond (to Dead River); elevation, 1,260 feet; one of the "Chain of Ponds."

Little Pond; Rome Township, Kennebec County; outlet to North Pond; combined area of Little and North ponds, 3.6 square miles; elevation, 253 feet.

Little Spencer Stream; rises in ponds in T. 4, R. 5, Somerset County; flows southward through Spencer Ponds into Spencer Stream.

Little Wood Pond; Attean Township, west-central Somerset County; inlets from Little Big Wood and Benjamin ponds; outlet to Wood Pond (to Moose River).

Locks Pond; Chesterville Township, Franklin County; outlet to Wilson Stream (to Sandy River).

Long Pond; T. 2, R. 6, northern Franklin County; inlets from Natanis and Pocket ponds and small brooks; outlet to Bog Pond (to Dead River); elevation, 1,260 feet; one of the "Chain of Ponds."

Long Pond; southwestern part of Hartland Township, Somerset County; outlet to Ebleys Pond (to Carrabassett Stream).

Long Pond; Jackman and Long Pond townships, north-central Somerset County; inlets, Moose River, Upper and Lower Churchill streams, and Parlin Stream; outlet, Moose River; area, approximately, 5 square miles; elevation, 1,155 feet; used for storage of water for log driving; dam commands a head of about 8 feet. See page 134 for additional information regarding this pond.

Long Pond; Parlin Pond Township, central Somerset County; outlet into Parlin Stream (to Moose River).

Long Pond; Rangeley and Dallas townships, west-central Franklin County; outlet into South Branch of Dead River.

Long Pond: Rome, Belgrade, and Mount Vernon townships, Kennebec County; inlets from Great Pond and several smaller ponds and brooks; outlet through Belgrade Stream to Messalonskee Lake; area, 4.2 square miles; elevation, 241 feet.

Long Pond; T. 1, R. 6, eastern Somerset County; outlet into Kennebec River.

Long Pond; T. 4, R. 5, western Somerset County; outlet into Spencer Stream.

Loon Pond; Litchfield Township, Kennebec County; outlet into Pleasant Pond (to Cobbosseecontee River); elevation, about 180 feet.

Lovejoy Pond; Albion Township, Kennebec County; outlet into Sebasticook River through Fifteenmile Brook; area, 0.7 square mile (Wells).

Lower Churchill Stream; rises in small ponds in Thorndike Township, north-central Somerset County; flows southeastward into Long Pond (to Moose River).

Lower Pond; T. 2, R. 6, northern Franklin County; inlet from Bog Pond, Dead River; outlet, North Branch of Dead River.

Luther Pond; Thorndike Township, central Somerset County; outlet, Brassua Stream (to Brassua Lake).

Maranacook Lake; Readfield and Winthrop townships, Kennebec County; inlets from Greeley and other small ponds; outlet to Lake Annabessacook; area, 2.5 square miles; elevation, 215 feet. Called by Wells "North Pond."

Martin Stream; rises in Concord Township, Somerset County; flows southeastward into Kennebec River.

McGrath Pond; Oakland and Belgrade townships, Kennebec County; inlets, small brooks; outlet into Ellis Pond; area, 0.7 square mile; elevation, 273 feet.

McGurdy Pond; Sharon and Chesterville townships, Franklin County; outlet into Sandy River.

McKinney Pond; Holeb Township, western Somerset County; outlet into Moose River.

Merrill Pond; Concord Township, Somerset County; outlet to Kennebec River; elevation, 343 feet.

Messalonskee Lake; Oakland, Belgrade, and Sidney townships, Kennebec County; principal inlet, Belgrade Stream; outlet, Messalonskee Stream; area, 5.4 square miles; elevation, 235 feet. Called by Wells "Snow Pond."

Messalonskee Stream; rises in Messalonskee Lake, Oakland Township, Kennebec County; flows northeastward, then southeastward, and enters the Kennebec at Waterville; length, about 42 miles; drainage area, 208 square miles; fed by extensive lakes, the aggregate water surface of which is between 25 and 30 square miles; flow very constant and fall large; extensively utilized for power. Called by Wells "Emerson Stream." Gaging station at Waterville, established 1903, discontinued 1906; drainage area at this point, 205 square miles.

Michael Stream; rises in southeastern part of Jerusalem township, Franklin County; flows eastward into Sandy Stream, a tributary of Carrabassett River.

Michael Stream; rises in Solon Township, Somerset County; flows southwestward into Kennebec River about 3 miles below Solon.

Mill Pond; Harmony Township, Somerset County; outlet into Moose Pond (to Sebasticook River); area, 1.1 square miles (Wells).

Mill Pond; Pleasant Ridge Township, Somerset County; outlet into Kennebec River; elevation, 1,149 feet.

Mill Stream; rises in Embden Pond, Emden Township, Somerset County; flows southeastward into Carrabassett River.

Mill Stream; rises in Jackson Lake, Concord Township, Somerset County; flows southward into Martin Stream, a tributary of the Kennebec.

Mill Stream; rises in Norridgewock Township, Somerset County; flows northeastward into Kennebec River at Norridgewock.

Mink Brook; rises in Mink Ponds; flows southward into Austin Stream.

Mink Brook; rises in western part of Forks Plantation, Somerset County; flows southwestward into Kennebec River.

Mink Ponds; Moscow Township, Somerset County; outlet to Austin Stream; elevation, 1,240 feet.

Miseree Pond; Misery Township, east-central Somerset County; outlet, Miseree Stream (to Brassua Lake); area, approximately; area 1.5 square miles (Wells).

Miseree Stream; rises in Miseree Pond, Misery Township, east-central Somerset County; flows northeastward into Brassua Lake (to Moose River).

Moores Pond; T. 4, R. 7, west-central Somerset County; outlet into Horse Brook, a tributary of Moose River.

Moose Brook; rises in eastern Somerset County; flows southeastward into Moosehead lake.

Moose Brook; rises in T. 4, R. 7, central Somerset County; flows northwestward into Horse Brook, a tributary of Moose River.

Moosehead Lake; eastern Somerset and western Piscataquis counties; inlets, Roach and Moose rivers and a number of small streams; outlet, Kennebec River; area, about 115 square miles; drainage area at mouth, 1,240 square miles; elevation, 1,026 feet; used for storage of water for water power and log driving; dam commands a head of 7.5 feet over entire surface; navigable by steamboats from end to end. See pages 132-133 for information regarding storage capacity, etc.

Moose Pond; Harmony and Hartland townships, Somerset County; outlet to Sebasticook River; inlets from Mill, Starbird, and Stafford ponds and a number of brooks; area, approximately, 9.50 square miles (Wells).

Moose Pond; Mount Vernon Township, Kennebec County; outlet into Belgrade Stream, a tributary of Messalonskee Lake; elevation, about 400 feet.

Moose River; rises in the extreme northern part of Franklin County; flows in a general direction a little north of east and enters Moosehead Lake from the west; length, about 70 miles; drainage area, 680 square miles. The stream passes through Attean, Wood, and Long ponds and Brassua Lake, and receives the drainage from a large number of small ponds well scattered over the basin. Gaging station near Rockwood, established 1902; drainage area at this point, 680 square miles.

Mosquito Pond; Forks Plantation, eastern Somerset County; outlet into Moxie Pond.

Moxie Pond; East Moxie Township, eastern Somerset County; inlets, Alder, Sandy, and Baker streams and several small ponds and brooks; outlet through Moxie Stream into Kennebec River; area, 2.6 square miles; drainage area at outlet, 80 square miles; elevation, 965 feet; commanded by a dam affording a head of 9 feet; used for water storage for log driving. See page 138 for fuller information.

Moxie Stream; rises in Moxie Pond, eastern Somerset County; flows westward into Kennebec River; has a fall of 370 feet in 4 miles, one fall of 95 feet being nearly vertical; total drainage area, 92 square miles.

Mountain Pond; central Somerset County; outlet northeastward into Dimmick Ponds; elevation, 2,000 feet.

Muddy River; rises in Topsham Township, Sagadahoc County; flows northeastward into Kennebec River at Merrymeeting Bay.

Mud Pond; Embden Township, Somerset County; outlet into Fahi Pond.

Mud Pond; Thorndike Township, north-central Somerset County; outlet into Lower Churchill Stream.

Muskrat Pond; Thorndike Township, north-central Somerset County; outlet into Lower Churchill Stream.

Narrows Pond; Winthrop Township, Kennebec County; inlet from Carlton Pond; outlet into Lake Annabessacook; area, 0.8 square mile; elevation, approximately, 180 feet.

Natanis Pond; T. 2, R. 6, northern Franklin County; inlet from Round Pond, Dead River; outlet into Long Pond (to Dead River); elevation, 1,260 feet; one of the "Chain of Ponds."

Nehumkeag Pond; Pittston Township, Kennebec County; outlet into Kennebec River.

Nequasset Brook; rises in Dresden Township, Lincoln County; flows southward through Nequasset Pond into Kennebec River at Woolwich, opposite Bath.

Nequasset Pond; Woolwich Township, Sagadahoc County; inlets from Nequasset and other brooks; outlet into Kennebec River; area, 0.6 square mile; elevation, 18 feet.

Nokomis Pond; Palmyra Township, Somerset County, and Newport Township, Penobscot County; outlet into Sebasticook Lake.

Norcross Brook; rises in western Piscataquis County; flows northwestward into Moosehead Lake.

Norcross Pond; Chesterville Township, Franklin County; outlet into Sandy River; area, 0.35 square mile (Wells).

North Boundary Pond; T. 3, R. 6, northern Franklin County; outlet into North Branch of Dead River; elevation, 2,061+ feet.

North Pond; on boundary between Smithfield and Mercer townships, Somerset County, and Rome Township, Kennebec County; inlets from East and Little ponds; outlet into Great Pond; combined area of North and Little ponds, 3.6 square miles; elevation, 253 feet.

North Pond; Temple and Wilton townships, Franklin County; outlet into Sandy River; area, about 1 square mile (Wells).

North Pond; Chesterville Township, Franklin County; outlet into Sandy River; area, about 1 square mile (Wells?).

It is not certain to which of the three foregoing ponds Wells referred in his list of ponds connected with Sandy River. As shown on Scarborough's map of southwestern Maine, they differ little in size from Norcross Pond, the area of which is given as 0.35 square mile.

Northwest Boundary Pond; T. 3, R. 6, northern Franklin County; outlet into North Branch of Dead River; elevation, 2,061 feet.

Oak Pond; Skowhegan Township, Somerset County; inlet from Lake George; outlet into Carrabassett Stream.

Otter Pond; T. 2, R. 6, northern Franklin County; outlet into North Branch of Dead River; elevation, 1,360+ feet.

Otter Ponds; central Somerset County; outlet into Kennebec River; area, two ponds, 0.5 square mile.

Palmyra Ponds; Palmyra Township, Somerset County; outlet into Sebasticook River; combined water surface, two ponds, 0.6 square mile (Wells).

Parker Pond; T. 3, R. 5, western Somerset County; outlet to Spencer Stream.

Parlin Pond; Parlin Pond Township, central Somerset County; outlet, Parlin Stream to Long Pond (to Moose River); area, approximately, 2.75 square miles (Wells)

Parlin Stream; rises in Parlin Pond, Parlin Pond Township, central Somerset County; flows northeastward into Long Pond (to Moose River).

Pattee Pond; Winslow Township, Kennebec County; outlet into Sebasticook River; area, 0.85 square mile (Wells); elevation, about 120 feet.

Perham Stream; rises in Mount Abraham Township, Franklin County; flows southward and southwestward into Sandy River.

Pierce Pond; central Somerset County; outlet into Kennebec River; area, about 2.3 square miles; drainage area at outlet, 18 square miles; elevation, about 1,125 feet (barometric); dam commands a head of about 10 feet; used for storage of water for log driving. See page 139 for additional information regarding this pond.

Pleasant Pond; Litchfield Township, Kennebec County, and Richmond Township, Sagadahoc County; inlets from a number of small brooks; outlet into Cobbosseecontee River; area, 1.1 square miles; elevation, 137 feet.

Pleasant Pond; central Somerset County; outlet, Pleasant Pond Stream; area, 1.6 square miles; drainage area at mouth, 5.9 square miles; elevation, 1,265 feet; 780 feet fall to Kennebec River in a distance of about 3.5 miles.

Pleasant Pond Stream; rises in Pleasant Pond, central Somerset County; flows southwestward into Kennebec River.

Plymouth Ponds; Plymouth Township, Penobscot County; inlets from Skinner Pond and small brooks; outlet into Sebasticook Lake; area, about 3 square miles (Wells).

Pocket Pond; T. 2, R. 6, northern Franklin County; outlet into Long Pond (to Dead River); elevation, 1,260 feet; one of the "Chain of Ponds."

Ponco Ponds; Moose River Plantation, western Somerset County; outlet to Moose River.

Poplar Brook; rises in Jerusalem Township, Franklin County; flows southwestward into Carrabassett River at Carrabassett.

Prong Pond; western part of Piscataquis County; outlet to Moosehead Lake.

Purgatory Ponds (3); Litchfield Township, Kennebec County; inlet from Sand Pond; outlet into Cobbosseecontee River; area of largest pond, 0.7 square mile; elevation, 175 feet.

Rapid Stream; rises in Jerusalem Township, Franklin County; flows southeastward, then northeastward, into Carrabassett River at Kingfield.

Redington Brook; rises in Redington Ponds, central Franklin County; flows southwestward, then northwestward, into South Branch of Dead River.

Redington Ponds; Redington Township, central Franklin County; outlet into Redington Brook.

Reed Brook; rises on Mount Bigelow, Bigelow Township, western Somerset County; flows northward into Dead River.

Richard Pond; Winthrop Township, Kennebec County; inlet from Shed Pond; outlet into Cobbosseecontee Pond; elevation, about 180 feet.

Ritt Brook; rises in southwestern part of Mayfield Township, Somerset County; flows northward into South Branch of Austin Stream.

Roach Ponds; west-central Piscataquis County; outlet through Roach River to Moosehead Lake; three ponds, known as Upper, Middle, and Lower, with areas, respectively, of 1.5, 1.5, and 5 square miles; dam on each pond; used for log driving. See pages 137–138 for further description of these ponds.

Roach River; receives headwaters from slopes of Boardman and White Cap mountains, west-central Piscataquis County; flows northwestward through a series of three ponds, and empties into Spencer Bay on east side of Moosehead Lake; length, about 10 miles; drainage basin completely forested; total area at mouth, 120 square miles; no large tributary streams; three ponds of importance—Upper, Middle, and Lower Roach ponds; river utilized for log driving; gaging station at Roach River established in 1901; drainage area at this point, 85 square miles.

Robinson Pond; on boundary between Carritunk and Spaulding townships, eastern Somerset County; inlet from Doughnut Pond; outlet into Pleasant Pond Stream; elevation, 1,478 feet.

Robinson Pond Outlet; rises in Robinson Pond; flows northwestward through Deer Bog and Moores Bog to Pleasant Pond Stream.

Rock Pond; Tps. 5 and 6, Rs. 6 and 7, western Somerset County; outlet into Spencer Stream.

Rogers Pond; St. Albans Township, Somerset County; outlet into Little Indian Pond (to Sebasticook River); area, about 0.9 square mile (Wells).

Rolling Dam Brook; rises in southern part of Gardiner Township, Kennebec County; flows northeastward and eastward into Kennebec River near Gardiner.

Round Mountain Lake; Alder Stream Township, northern Franklin County; outlet to Little Alder Stream.

Round Pond; T. 2, R. 6, northern Franklin County; inlet, Dead River; outlet to Natanis Pond, Dead River; elevation, about 1,260 feet; one of the "Chain of Ponds."

Rowe Ponds; Pleasant Ridge Township, Somerset County; outlet through Sandy Stream to Carrabassett River; inlets from several small ponds; area of largest pond, 0.7 square mile (Wells); elevation, 1,209 feet.

Rowe Pond Stream; rises in Rowe Ponds, Pleasant Ridge Township, Somerset County; flows southwestward, uniting with East Brook to form Sandy Stream, a tributary of Carrabassett River.

Saddleback Ponds (2); near Saddleback Mountain, in northern part of Sandy River Township, west-central Franklin County; outlet to Dead River Pond (to South Branch of Dead River).

Sally Pond; Dennes Township, western Somerset County; outlet into Moose River.

Salmon Stream; rises in Johnson Mountain, T. 2, R. 6, central Somerset County; flows southeastward into Dead River.

Sanborn Pond; Manchester and Farmingdale townships, Kennebec County; outlet into Cobbosseecontee River; inlet from Jamies Pond; elevation, about 180 feet.

Sand Pond; Chesterville Township, Franklin County; outlet into Wilson Stream (to Sandy River).

Sand Pond; Litchfield Township, Kennebec County; inlet from Buker Pond; outlet into Purgatory Pond (to Cobbosseecontee River); elevation, about 175 feet.

Sandy Pond; Embden Township, Somerset County; outlet to Fahi Pond; area, 0.4 square mile (Wells); elevation, 413 feet.

Sandy Pond; Freedom Township, Waldo County; outlet to Sebasticook River; area, about 0.9 square mile (Wells).

Sandy River; rises in western part of Franklin County in the hilly region east of Rangeley Lake; flows southeastward about 32 miles, then northeastward 17 miles, entering the Kennebec about 3 miles below Madison; drainage area, 670 square miles; no large tributaries or ponds; total fall about 1,600 feet, mostly in upper part of basin. Gaging station near Madison established in 1904; drainage area at this point, 650 square miles.

Sandy River Ponds; Sandy River Township, Franklin County; outlet, Sandy River; area, four ponds, 1 square mile (Wells).

Sandy Stream; rises in East Moxie Township, eastern Somerset County; flows southwestward into Moxie Pond.

Sandy Stream; rises in Highland Township, Somerset County, being formed by union of East Brook and Rowe Pond, which drain Middle Carrying Place and Rowe ponds; flows southward through Gilman Pond to Carrabassett River.

Savage Pond; northwestern Cornville Township, Somerset County; outlet to Wesserunsett Stream.

Sebasticook Lake; Newport Township, Penobscot County; inlets from Stetson and Corinna ponds and several small brooks; outlet to Sebasticook River; area, approximately 7.5 square miles (Wells). Called by Wells "Newport Pond."

Sebasticook River; rises in ponds in southeastern Somerset and western Penobscot counties; flows in general southwestward 45 miles to Kennebec River at Winslow, opposite Waterville; drainage area, 970 square miles; many tributary ponds, covering in all about 50 square miles; total fall, about 170 feet; extensively used for power.

Sebleys Pond; Canaan and Pittsfield townships, Somerset County; outlet to Kennebec River through Carrabassett Stream

Sevenmile Brook; rises in Spectacle, Tolman, and Dam ponds, Augusta Township, Kennebec County; flows northwestward into Kennebec River about 5 miles above Augusta.

Shallow Pond; Jim Pond Township, northeastern Franklin County; outlet into North Branch of Dead River.

Shed Pond; Manchester Township, Kennebec County; outlet into Richard Pond (to Cobbosseecontee Pond); elevation, about 320 feet.

Skinner Pond; Dixmont Township, Penobscot County; outlet to Plymouth Ponds (to Sebasticook Lake); area, approximately 0.7 square mile (Wells).

Smith Pond; Parlin Pond and Misery townships, central Somerset County; outlet to Parlin Stream.

Snow Pond; Alder Stream Township, northern Franklin County; outlet into Little Alder Stream.

Socatean River; rises in Plymouth or Boyd Township, eastern Somerset County; flows southeastward into Moosehead Lake.

South Boundary Pond; T. 3, R. 6, northern Franklin County; outlet into North Branch of Dead River; elevation, 2,061+ feet.

Spectacle Pond; T. 4, R. 5, western Somerset County; outlet into Kibby Stream, a branch of Spencer Stream.

Spectacle Pond; Vassalboro and Augusta townships, Kennebec County; outlet into Kennebec River through Sevenmile Brook.

Spencer Pond; western Piscataquis County; outlet into Moosehead Lake; three small inlets; area, approximately, 1.5 square miles (Wells).

Spencer Ponds; Tps. 3 and 4, Rs. 5 and 6, western Somerset County; inlet drains several small ponds; outlet into Spencer Stream; area, approximately, 2.6 square miles; elevation, about 1,150 feet (barometric); dam commands 16-foot head when pond is filled; used for log sluicing. See page 141 for additional information regarding these ponds.

Spencer Stream; rises in T. 5, R. 6, western Somerset County; flows southwestward, then southeastward, into Dead River; many tributary ponds; largest are Spencer Ponds, which reach Spencer Stream by way of Little Spencer Stream. See page — for additional information regarding this stream.

Spring Lake; T. 3, R. 4, western Somerset County; outlet to Dead River; area, approximately, 1.1 square miles; elevation, about 1,260 feet above mean sea level (barometric) and 260 feet above Dead River. Called by Wells "Long Lake." See page 140 for additional information regarding this lake.

Spruce Pond; Lexington Township, Somerset County; outlet through Witham Brook to Embden Pond; area, 0.35 square mile (Wells).

Squaw Brook; rises in Fitzgerald Pond, near Squaw Mountain, western Piscataquis County; flows southeastward into Moosehead Lake.

Stafford Pond; Hartland Township, Somerset County; outlet to Moose Pond (to Sebasticook River); area, 0.35 square mile (Wells).

Starbird Pond; Hartland Township, Somerset County; outlet to Moose Pond (to Sebasticook River); area, 0.35 square mile (Wells).

Stetson Pond; Stetson Township, Penobscot County; outlet to Sebasticook Lake; area, about 2.5 square miles (Wells).

Stony Brook; rises in central part of Highland Township, Somerset County; flows southeastward into Sandy Stream, a tributary of Carrabassett River.

Stony Brook; rises in Thorndike Township, central Somerset County; flows southeastward into Moose River.

Stratton Brook; rises on Mount Bigelow, T. 4, R. 3, Franklin County; flows westward and northwestward into South Branch of Dead River.

Tee Pond; Jim Pond Township, northern Franklin County; outlet to Tim Brook (to North Branch of Dead River).

Ten Thousand Acre Ponds; southern boundary of Misery township, eastern Somerset County; outlet to Chase Stream (to Kennebec River).

Three-Cornered Pond; Augusta Township, Kennebec County; outlet to Togus Ponds; elevation, 198 feet.

Threemile Pond; China and Windsor townships, Kennebec County; outlet to Weber Pond (to Kennebec River); area, 1.6 square miles; elevation, 180 feet.

Tim Brook; rises in Tim Pond, northern Franklin County; flows northeastward into North Branch of Dead River.

Tim Pond; western Eustis Township, northern Franklin County; outlet, Tim Brook.

Tobey Brook; rises about 1½ miles southeast of South Norridgewock, Somerset County; flows southward into Martin Stream (into Kennebec River).

Toby Ponds; T. 5, R. 7, western Somerset County; outlet to Moose River.

Togus Ponds; Augusta Township, Kennebec County; outlet through Togus River to Kennebec River; area, 1 square mile; elevation, 188 feet. Called by Wells "Worromotogus Pond."

Togus River; rises in Togus Ponds, Augusta, Township, Kennebec County; flows southwestward into Kennebec River at Randolph, opposite Gardiner.

Tolman Pond; Augusta Township, Kennebec County; outlet into Kennebec River through Sevenmile Brook; elevation, about 210 feet.

Tom Fletcher Stream; rises in Brassua Township, central Somerset County; flows southeastward into Moose River.

Tomhegan Pond; Middlesex Grant Township, eastern Somerset County; outlet into Moosehead Lake through Tomhegan Stream; area, approximately, 0.75 square mile (Wells).

Tomhegan Stream; rises in T. 2, R. 3, eastern Somerset County; flows southeastward into Moosehead Lake.

Trout Pond; west-central Piscataquis County; outlet into Middle Roach Pond.

Tufts Pond; Kingfield Township, Franklin County; outlet to Carrabassett River; area, 0.5 square mile (Wells).

Turner Brook; rises in southern part of Madison Township, Somerset County; flows southeastward into Kennebec River between Norridgewock and Skowhegan.

Turner Pond; Moscow Township, Somerset County; outlet into Kennebec River; elevation, about 500 feet.

Turner Pond (2); Forsythe and Holeb townships, western Somerset County; outlet into Holeb Pond.

Unity (Twenty-five Mile) Pond; Unity, Burnham, and Troy townships, Waldo County; outlet to Sebasticook River; area, approximately, 4.25 square miles (Wells).

Upper Churchill Stream; rises in Bog Pond, Bald Mountains, Moose River Plantation, western Somerset County; flows southeastward into Long Pond (to Moose River).

Viles Pond; Jim Pond Township, northern Franklin County; outlet into North Branch of Dead River.

Ward Pond; Sidney Township, Kennebec County; outlet to Messalonskee Lake; elevation, about 340 feet.

Weber Pond; Vassalboro Township, Kennebec County; inlet from Threemile Pond; outlet to Kennebec River; area, 1.9 square miles; elevation, 138 feet.

Weeks Pond; Brighton Township, Somerset County; outlet to Wesserunsett Stream.

Welhern Pond; Eustis Township, northeastern Franklin County; outlet to Tim Brook.

Wentworth Pond; Solon and Athens townships, Somerset County; outlet into Wesserunsett Stream; area, with Bakers Pond (unnamed on available maps), approximately 1 square mile (Wells).

Wesserunsett Stream; rises in Weeks Pond, Brighton Township, Somerset County; flows southward into Kennebec River in Skowhegan Township; drainage area (Tenth Census), 167 square miles; a rapid stream, affording numerous sites for power, many of which are unimproved; flow not very constant.

West Brook; rises in Highland Township, Somerset County; flows eastward into Sandy Stream, a tributary of Carrabassett River.

West Outlet Ponds; eastern Somerset County; outlet from Moosehead Lake to Indian Pond (to Kennebec River); area of three ponds, approximately, 1.25 square miles (Wells).

Weymouth Pond; Corinna Township, Penobscot County; outlet to Little Indian Pond (to Sebasticook River); area, 0.4 square mile (Wells).

Whipple Pond; T. 5, R. 7, western Somerset County; outlet into Spencer Pond.

Whitcomb Brook; rises in western part of Moscow Township, Somerset County; flows southwestward into Kennebec River.

Whites Pond; Palmyra Township, Somerset County; outlet into Palmyra Ponds (to Sebasticook River.)

Williams Stream; rises in eastern Somerset County; flows southeastward into Moosehead Lake.

Wilsons Pond; Wayne and Monmouth townships, Kennebec County; inlets from Dexter and Cochnewagon ponds; outlet into Lake Annabessacook; area, about 0.9 square mile (Wells).

Wilsons Pond; T. 1, R. 5, eastern Somerset County; outlet into Kennebec River.

Wilson Stream; rises in Temple Township, Franklin County; flows southeastward, then northeastward into Sandy River.

Wilton Pond; Wilton Township, Franklin County; outlet to Sandy River; area, approximately, 1.25 square miles (Wells). This is probably the pond called "Wilsons" by Wells.

Witham Brook; rises in Spruce Pond, Lexington Township, Somerset County; flows southeastward into Embden Pond.

Withee Pond; southwestern part of Mayfield Township, Somerset County; outlet through Gulf Stream to Austin Stream; elevation, about 1,360 feet.

Wood Pond; Attean Township, west-central Somerset County; inlets, Gander Brook, Wood Stream, and Moose River; receives also drainage from a number of small ponds; outlet, Moose River; area, about 3.3 square miles; elevation, 1,158 feet. See pages 135–136 for further information regarding this pond.

Wood Stream; rises in Forsythe Township, western Somerset County; flows southeastward through Little Big Wood and Little Wood ponds into Wood Pond (to Moose River).

Wyman Pond; Brighton Township, Somerset County; outlet into Wesserunsett Stream; area, 0.75 square mile (Wells).

Youngs Pond; northeastern Pleasant Ridge Township, Somerset County; outlet into Kennebec River; elevation, about 1,300 feet.

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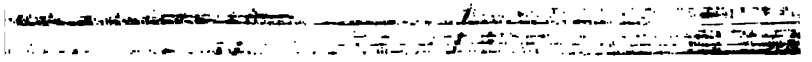

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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

UNDERGROUND WATER

IN

SANPETE AND CENTRAL SEVIER VALLEYS, UTAH

BY

G. B. RICHARDSON

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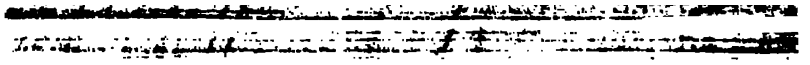

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UNDERGROUND WATER IN SANPETE AND CENTRAL SEVIER VALLEYS, UTAH.

By G. B. RICHARDSON.

INTRODUCTION.

Sanpete and central Sevier valleys are situated at the border of the Basin Range and Plateau provinces in south-central Utah. They are bounded on the east by the Wasatch and Sevier plateaus and on the west by the Gunnison Plateau and the Valley and Pavant ranges, and are drained by Sevier River, which empties into Sevier Lake in the Great Basin. (See fig. 1, p. 6.)

These valleys rank with the richest parts of the State. They were occupied a few years after the Mormon pioneers founded Salt Lake City, in 1847, when settlements, which soon became thriving farming communities, were established where water for irrigation was most available. A variety of crops, especially wheat, are successfully grown, and the valleys are popularly known as the "granary of Utah." Sheep raising is also an important industry, the adjacent highlands being used for summer pastures. The climate is arid, and there is a striking contrast between those areas which in their natural state are covered with sagebrush and grease wood and the fruitful cultivated tracts. (See Pl. I, *A* and *B*.) Trees are normally absent in the valleys, but they flourish to a limited extent on the adjacent highlands, where there are thin growths of quaking aspen, scrub oak, and stunted conifers. Irrigation is necessary for the production of crops.[a] Canal systems are maintained by San Pitch Creek and Sevier River, and the mountain streams are tapped by ditches near the mouths of the canyons, but this supply is insufficient and attention is being turned to the subterranean store..

This report is a preliminary statement of the general conditions of occurrence of underground water in Sanpete and central Sevier valleys. The field work was carried on in cooperation with Sanpete and Sevier counties through the State engineer, Mr. Caleb Tanner, who detailed Mr. C. S. Jarvis to collect the data embodied in the list of springs and wells on pages 51–60.

[a] Dry farming has not yet been extensively practiced here.

TOPOGRAPHY.

Sanpete and central Sevier valleys are structural troughs filled with "wash" derived from the adjacent highlands. They trend northeast-southwest, and are occupied by relatively small streams, Sevier River draining the southern, and its tributary, San Pitch

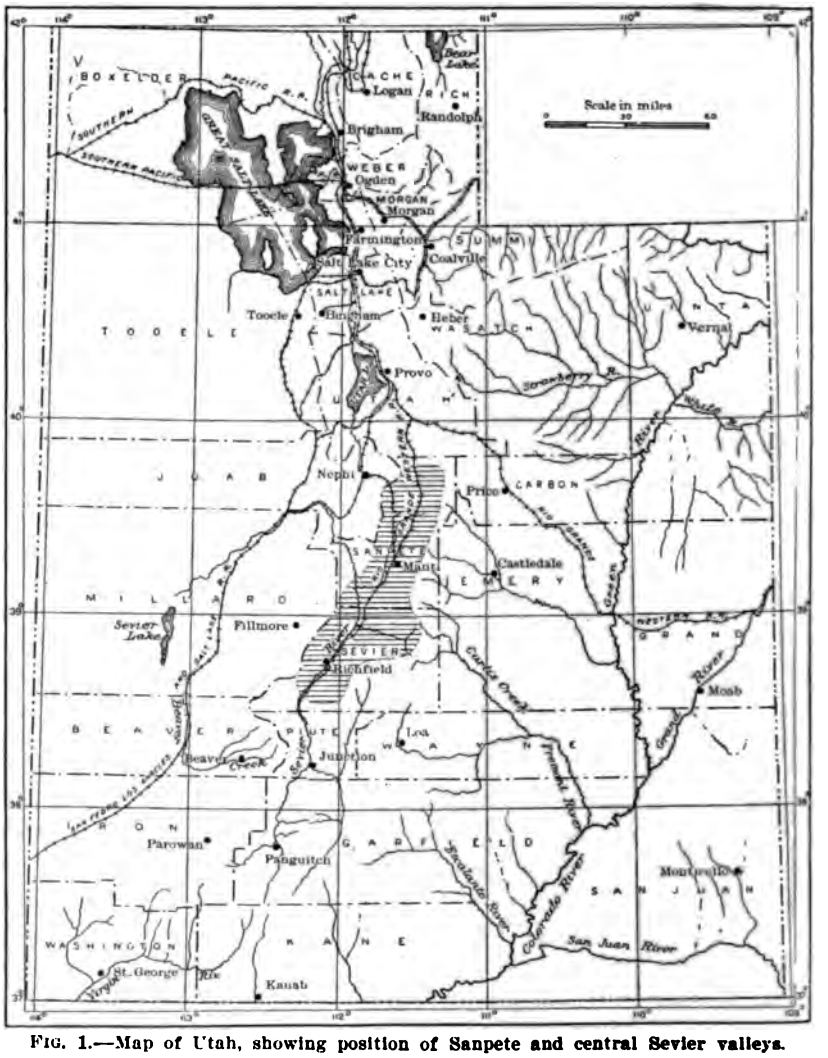


FIG. 1.—Map of Utah, showing position of Sanpete and central Sevier valleys.

Creek, the northern valley. Each valley is about 45 miles in length and averages 6 miles in width.

The main central streams have a number of tributaries, the more important of which flow from the eastern plateaus, where the precipitation is greater than on the relatively low and narrow western highlands. The streams flow perennially within the mountains,

where they occupy steep, narrow valleys, but at the mouths of the canyons the discharge is largely diverted by irrigation canals, and the lower courses in the broad lowlands are generally dry, except during floods. The chief tributaries of San Pitch Creek are Cottonwood, Pleasant, Cedar, Oak, Canal, Ephraim, Willow, Manti, Sixmile, and Twelvemile creeks, all of which have small drainage areas on the Wasatch Plateau. Salina Creek, draining 255 square miles, is by far the largest tributary stream. It flows in the depression between the Wasatch and Sevier plateaus and joins Sevier River 13 miles above Gunnison. The other important tributaries of the Sevier in its central valley are Lost and Monroe creeks, which rise in the Sevier Plateau.

The elevation of Sanpete and central Sevier valleys ranges from 5,000 feet above sea level in their lower parts to about 6,000 feet at the upper border of the lowlands, above which the mountains rise from 2,000 to 5,000 feet higher.

Gunnison Plateau, bordering Sanpete Valley on the west and separating it from Juab Valley, is 35 miles long and varies from 2 to 8 miles in width. The plateau is considerably dissected, and only remnants of its former surface are preserved by horizontal beds of limestone. At its northern end the plateau has an elevation of almost 10,000 feet, but it slopes southward and merges into Sevier Valley at Gunnison. A sparse growth of vegetation is supported on the Gunnison Plateau, from which only a few feeble streams are tributary to Sanpete Valley.

The Wasatch Plateau borders Sanpete Valley on the east and extends as far south as the valley of Salina Creek. The crest of the plateau is underlain by Cretaceous and Tertiary sediments, which, on the east, form a wall of erosion, beyond which the surface slopes to Castle Valley, a lowland underlain by shale, which separates the plateau from the San Rafael swell. On the west the Wasatch Plateau slopes toward Sanpete Valley, conforming with a great monoclinal flexure. The Wasatch Plateau is comparatively well timbered and is the source of a number of perennial streams.

Sevier Plateau forms the greater part of the eastern boundary of Sevier Valley, above which it rises abruptly, and extends from the valley of Lost Creek far to the south of the area under consideration. Its culminating point is Monroe Peak, whose elevation is 11,240 feet. The plateau is underlain by a series of igneous rocks, chiefly Tertiary tuffs and lavas. The East Fork of Sevier River receives a considerable part of the drainage of Sevier Plateau, but Monroe Creek is the only important stream that drains directly from it into the area here considered.

Central Sevier Valley is bounded on the west by the Pavant and Valley mountains, which are the easternmost parts of the Basin

Ranges in this latitude. The Pavant Mountains are about 35 miles long and from 4 to 12 miles wide and are much dissected, their crest forming a narrow ridge about 10,000 feet in elevation. The range is but fairly well timbered and only a few small creeks flow from it to the valley. The eastern slopes are underlain by east-dipping strata, which unconformably overlie Paleozoic limestone. The Valley Mountains lie between the Gunnison Plateau and the Pavant Mountains, of which they are a faulted offset. They are 25 miles long, average 5 miles in width, and are about 7,000 feet high. They are practically bare of vegetation and give rise to no important streams.

GEOLOGY.

Sanpete and Sevier valleys are represented on the map of the Wheeler Survey [a] and are described in Dutton's report on the geology of the High Plateaus of Utah,[b] but no detailed geologic work has yet been done in this region. The character and structure of the rocks are fairly well known, however, and the following brief summary, together with the maps and sections (Pls. II, III, V, and VI), indicates the general geologic conditions of occurrence of underground water.

The rocks of these valleys can conveniently be classified as consolidated "bed rocks," which outcrop chiefly on the highlands, and unconsolidated deposits, which occur in the broad central valleys. Strata of Mesozoic and Tertiary age occupy the greater part of the highlands, and igneous rocks are found in their extreme southern portion. The valleys, on the other hand, are underlain to considerable depths by débris derived from the disintegration of the adjacent highlands. The underground water occurs chiefly in the unconsolidated deposits, but water contained in the bed rocks is locally important.

BED ROCKS.

JURASSIC SYSTEM.

So far as known, the oldest rocks of Sanpete and Sevier valleys are of Jurassic age. They consist of a considerable but undetermined thickness of fissile clay shales, generally drab in color, but locally red, with some intercalated layers of drab sandstone ranging in thickness from a few inches to a few feet. Lenses of gypsum and rock salt are irregularly interbedded throughout the formation. These rocks outcrop in a range of low hills, about 30 miles long and 2 miles wide, that extend along the eastern margin of Sevier Valley from Glenwood to the vicinity of Mayfield. A less extensive outcrop

[a] U. S. Geog. Surv. W. 100th Mer., Atlas.

[b] Dutton, C. E., Geology of the High Plateaus of Utah: U. S. Geog. and Geol. Surv. Rocky Mt. Region, 1880.

occurs in the center of the valley, mostly west of Sevier River, between Redmond and Gunnison. On the east a fault causes these Jurassic strata to abut against Tertiary beds, as mentioned later, but relations are generally concealed by Quaternary deposits. The hills are practically bare of vegetation, and the soft beds have been eroded into badland topography. These rocks are of no value in the recovery of underground water. They exert, however, an important deleterious influence upon the character of streams with which they come in contact because of the ready solubility of their interbedded salt and gypsum.

CRETACEOUS SYSTEM.

The Cretaceous system is represented by two divisions, the Colorado and the Laramie. A small outcrop of rocks of Colorado age occurs in the valley of Salina Creek just above the mouth of the canyon, about 3 miles from Salina. These are a thin-bedded buff sandstone, with subordinate drab shale carrying *Inoceramus labiatus*.[a] At the western limit of their outcrop the Colorado strata stand almost vertical and are directly overlain by horizontal Eocene beds. Because of their limited exposure these rocks also are unimportant in the recovery of underground water.

Sandstones and shales provisionally referred to the Laramie division of the Cretaceous occupy a much greater area. The coal-bearing Laramie beds of Carbon County, which outcrop along the eastern scarp of the Wasatch Plateau, are conformably overlain by massive, loose-textured, buff sandstone, with subordinate interbedded buff shale. The thickness of these rocks has not been determined, but it amounts to several hundred feet.[b] They locally cap the plateau and outcrop along its middle western flanks east of Sanpete Valley as far as Spring Creek, and are exposed farther south in the valleys of several creeks that have cut deeply into the Wasatch monocline.

The only fossils that have been found in this formation on the Wasatch Plateau are a few obscure fragments of leaves, but in what is probably the same formation, in a fault block south of Manti, in which the Sterling coal[c] occurs, a number of plant remains have been found. Among them F. H. Knowlton recognizes *Sabal?* cf. *Sabalites Grayanus*, *Asimina eocenica?* Lesq., and *Salix* sp.? From these he concludes that the formation is probably of Laramie age.

At many localities on the Wasatch Plateau these rocks are overlain, apparently conformably, by Eocene strata. Different sections at the base of the known Tertiary, however, show deposits so diverse and

[a] Determined by T. W. Stanton.

[b] Taff, J. A., Book Cliffs coal field, Utah: Bull. U. S. Geol. Survey No. 285, p. 292.

[c] Richardson, G. B., Coal in Sanpete County, Utah: Bull. U. S. Geol. Survey No. 285, p. 280.

thicknesses so different that there is no conformity in the sense of a succession of widespread, uniform, uninterrupted deposits. In the vicinity of Sterling a distinct local unconformity is marked by flat Tertiary beds resting on highly inclined Laramie(?) sandstone.

The sandstone on the flanks of the Wasatch Plateau is a probable source of artesian water. (See p. 22.)

UNDETERMINED AGE.

A considerable thickness of red and buff conglomerate and sandstone, amounting to at least 2,000 feet, is exposed on the eastern flanks of the Pavant Mountains and Gunnison Plateau. The conglomerate is composed of rounded pebbles of quartzite and subordinate limestone of variable size, up to 1 foot in diameter, embedded in a sandy matrix. The main mass of conglomerate is overlain by fine-textured sandstone, but intercalated with the sandstone there are also beds of conglomerate. Drab shale of minor importance is locally interbedded with the sandstone. In the valley of upper Corn Creek, about 8 miles northwest of Elsinore, the basal conglomerate rests upon the eroded surface of steeply tilted Paleozoic sediments, and a similar conglomerate overlies upturned Carboniferous strata at the eastern base of Mount Nebo, about 15 miles northwest of Fountain Green. These conglomerates and sandstones, both on the Gunnison Plateau and on the Pavant Mountains, are overlain in apparent conformity by strata of Eocene age, but no fossils have been found in either the conglomerate or the sandstone, and the age of the rocks is as yet undetermined. The disconnected areas that have the same color on the map are grouped together only provisionally.

The conglomerate sandstone formation on the eastern flank of the Pavant Mountains is likely to prove a source of artesian water. (See p. 23.)

TERTIARY SYSTEM.

Strata of Eocene age outcrop on the summit and western flanks of the Wasatch Plateau, on the summit and eastern part of the Gunnison Plateau, and on the eastern slope of the valley and Pavant Mountains, and also form low ridges in Sevier and Sanpete valleys. These Tertiary sediments consist of at least 2,000 feet of drab, green, and red shales, buff and reddish sandstones, and whitish, fresh-water limestones. The stratigraphy is varied, and even adjacent sections are rarely alike. Numerous fresh-water fossils, including *Sphærium*, *Planorbis*, *Physa*, *Goniobasis*, and *Viripara*,[a] occur in these rocks, which are referred to the Wasatch stage of the Eocene. The following section was measured west of Wales.

[a] Identified by W. H. Dall.

Generalized section of Eocene rocks on Gunnison Plateau west of Wales.

	Feet.
Fine-textured white limestone	100+
Interval of talus	100
Gray limestone	10
Brown sandstone	10
Interval of talus	150
Brown sandstone	5
Drab limestone	15
Brown sandstone	10
Drab limestone	5
Interval of talus	100
White limestone	10
Drab shale	50
Buff limestone	15
Drab shale	50
Interval of talus	150
Drab limestone	10
Drab shale with streaks of purple shale	150
Brown sandstone	20
Drab shale with few thin beds of limestone	250
Brown sandstone	5
Drab shale	25
Brown sandstone	10
Buff shale	100
Gray limestone	25
Black limestone	5
Coal and bone	7
Black limestone	10
Dark shale	15
Brown sandstone	10
Drab shale	10
Gray limestone	5
Buff shale	40
Sandstone	10

The coal noted above is locally important,[a] but is not of widespread occurrence.

Younger Eocene strata outcrop in low ridges in Sanpete Valley, extending northward from Manti. They dip westward at low angles and their outcrops are surrounded by Quaternary deposits which conceal relations with the underlying rocks exposed on the flanks of the adjacent plateau. These younger rocks consist of light-colored sandstone, shale, and limestone, including a bed of oölitic limestone, and contain well-preserved specimens of fishes, turtles, etc. Cope[b] named them the Manti beds and regarded them as middle Eocene, corresponding to the Wind River stage. Because of insufficient knowledge concerning the base of the formation it is not differentiated here.

[a] Richardson, G. B., Coal in Sanpete County, Utah: Bull. U. S. Geol. Survey No. 285, p. 202.

[b] Cope, E. D., The Manti beds: Am. Naturalist, vol. 14, 1880, p. 303.

but is mapped as Eocene, together with the strata referred to the Wasatch stage.

The varying stratigraphy of Eocene strata, the prevalence of shale and limestone, and the minor occurrence of more pervious strata render the rocks of little importance as water reservoirs. Yet these relatively impervious beds serve to confine water in the underlying sandstones and conglomorates, and are thus important factors in the occurrence of artesian water.

IGNEOUS ROCKS.

Igneous rocks are unimportant as water reservoirs in Sanpete and Sevier valleys, for they occupy small areas and are massive, fine textured, and of low porosity. Their occurrence is chiefly restricted to the upper part of central Sevier Valley, to the Sevier Plateau south and east of Richfield, and to the base of the Pavant Range, west of Elsinore. They constitute the northern end of a mass which is well developed farther south. These rocks are for the most part a complex series of lavas that were poured out upon eroded surfaces of the underlying strata at different intervals in Neocene time.[a]

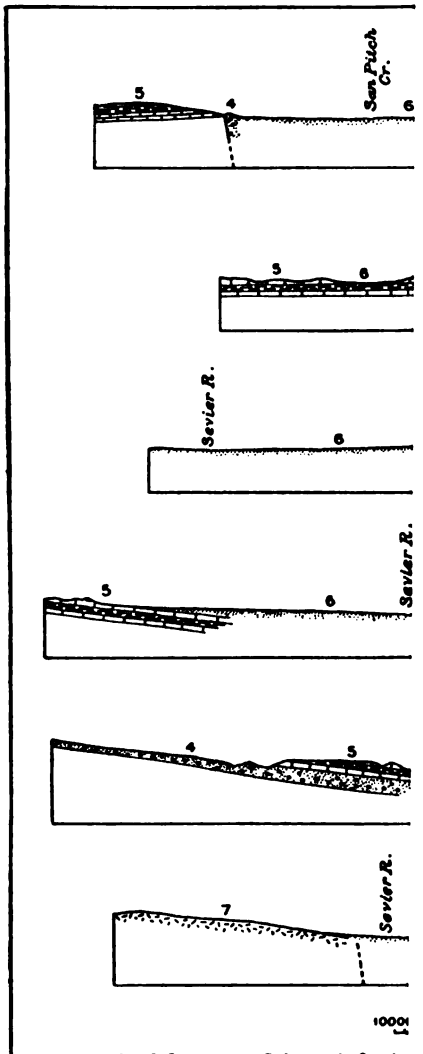
VALLEY DEPOSITS.

QUATERNARY SYSTEM.

The broad central floor of Sanpete and Sevier valleys is composed of fine-textured soils, chiefly sand and clay loam, but toward the highlands the material becomes coarser and the mountains are flanked by alluvial fans and slopes consisting of sand and gravel, with subordinate clay, the coarser material preponderating near the mountains. These deposits are derived from the disintegration of the adjacent highlands and transported to the valley by streams. In their mountain courses the volume and velocity of the creeks are considerable, especially during floods, and their carrying power is proportionally large, but upon entering the valley both volume and velocity decrease, the result being that the coarser materials carried by the streams are dropped near the base of the highlands while the finer débris is borne farther into the lowlands. Alluvial fans, consisting of heterogeneous masses of coarse sand and gravel, are thus formed about the mouths of the canyons (Pl. I, *A*), and alluvial slopes accumulate along the base of the mountains between the creeks, chiefly as the result of torrential storms.

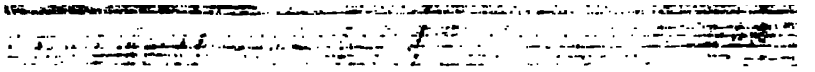
The deposits beneath the surface of the broad valleys consist of gravel, sand, and clay, the thickness of which is considerable, but

[a] Dutton, C. E., Geology of the High Plateaus of Utah: U. S. Geog. and Geol. Surv. Rocky Mt. Region, 1880.



1. Jurassic? 2. Colorado 3. Laramie? 4.

STRUCTURAL SEC



; minimum depths in the main part of the valleys are 530
evier and 650 feet in Sanpete Valley, as shown by two wells,[a]
r of which was consolidated rock found.
ng beds of gravel, sand, and clay, from
ches to many feet in thickness, are en-
l in driving wells. Few records have
t, however, and the detailed underground
ion of the valley deposits remains to be
ed. In general, coarse material prepon-
near the highlands and finer textured
more abundant in the lowlands, the incli-
the deposits being toward the valleys, in
de of deposition. Sections, even of neigh-
ells, can rarely be correlated, which im-
t the deposits, instead of having wide
istribution, as homogeneous beds, consist
of lenses, with imperfect connection, as
d in the section forming fig. 2. These
are in large part loose, porous, and satu-
h water, and constitute the most import-
rground reservoirs of the region.

FIG. 2.—Hypothetical section across Sanpete Valley.

STRUCTURE.

ata that cap the highlands lie practically
ave been tilted and faulted along the mar-
he lowlands, and the central valleys are
l depressions. The rocks are not folded
rict sense of the term, but incident to the
f the plateaus monoclinal flexures and
aults have been developed. (See Pl. III.)
picuous structural feature of the region
onocline that marks the western border
Vasatch Plateau. Near the rim of the
he strata dip westward, and along the
dip slope of large proportions is devel-
See Pl. IV, *B*.) On this the strata that
on the summit descend between 4,000 and
t in about 5 miles and pass beneath the
oor. Other large monoclines appear on
s of the Pavant and Valley ranges, where
at dip eastward at a low angle descend
Sevier Valley. The Jurassic shales that
n a narrow belt between Glenwood and Mayfield constitute

[a] Nos. 101*a* and 186, pp. 53 and 55.

another conspicuous zone of tilted strata. Throughout their extent they dip eastward at an average angle of 45°.

One of the prominent faults in the area under consideration intersects the eastward-dipping strata of the Pavant Mountains at the base of the range. This fault extends along the border of the valley to a point about 8 miles north of Richfield, where it turns northwestward and causes the Eocene shales and limestones to abut against the underlying upthrown red conglomerates.

The abrupt rise of Sevier Plateau several thousand feet above the valley and the presence of springs along its base indicate a fault, and a number of displacements that can be traced east of the valley and parallel to it lie between Glenwood and Manti. The eastward-dipping shales there form an upthrust block bounded on the east and west by north-south trending faults, by which the Jurassic beds are brought into contact with Eocene strata. The northern end of this block adjoins a much-disturbed zone between Mayfield and Manti, where the area between the Gunnison and Wasatch plateaus has been broken by several approximately parallel faults, as shown by the map and sections. The southwestern flank of the Wasatch Plateau is traversed by a number of minor parallel displacements, which fade away to the north and have not been traced beyond Manti Creek. Along the eastern base of the Gunnison Plateau a fault brings the red conglomerate with a high eastward dip against practically horizontal Eocene limestones and shales. The throw of some of the faults is considerable, but data are lacking for close measurement.

These structural features have an important bearing on the occurrence of underground water, as described on pages 25–27. A number of strong springs are associated with the faults, and the monoclinal flexures control the occurrence of water under pressure.

SOURCE OF UNDERGROUND WATER.

The underground water supply of Sanpete and Sevier valleys is derived from the rain and snow that fall on their drainage areas. Of the total precipitation, part evaporates, part flows off in streams, and part sinks into the ground. The relative amounts that are thus disposed of vary greatly under different conditions, and a complex series of changes ensues between precipitation and the final disappearance of the water from the drainage basin. Evaporation occurs either directly—from snow, from a free surface of water, and from water contained in soils—or indirectly, by transpiration through the growth of plants. Of the portion of the precipitation that joins the run-off, part leaves the basin in surface streams and part is absorbed by the soils and rocks over which the streams flow. The underground supply is further augmented by direct absorption from the surface on

A. FAULT SPRING WEST OF FOUNTAIN GREEN.

B. THE WASATCH MONOCLINE AND MANTI CREEK.

which the rainfall occurs. Part of the subterranean waters find their way back to the surface in springs, another part is consumed by the growth of organisms and by mineralogical changes, and a third part joins the more permanent supply of underground water.

PRECIPITATION.

Precipitation on the highlands, especially snow, which falls early and lingers late, is the chief source of supply of the streams which, as will presently be shown, are the most important contributors to the store of underground water in the valleys. There are no records of precipitation on the highlands, but the marked difference in vegetation between the forested mountains and the naturally desert valleys implies a considerably greater amount on the former. In the valleys, on the other hand, rainfall data have been kept for a number of years, although this precipitation contributes relatively little to the supply of underground water.

The mean annual amount for the past seven years ranges from 6.73 inches at Richfield to 11.37 at Mount Pleasant, and of this about 40 per cent falls during January, February, and March, when the frozen condition of the ground is unfavorable for absorption. Besides the direct run-off, much of the precipitation in the valley joins the streams as seepage run-off, and, in addition to the water that is lost through plant growth, large amounts are evaporated from the ground, the supply being maintained by capillary action. A considerable part of the rainfall on the valley is therefore lost by run-off and evaporation. The remainder replenishes the more permanent supply of underground water, relatively large quantities being absorbed by areas that are underlain by porous sand and gravel.

The following tables of precipitation at Richfield, Manti, and Mount Pleasant, compiled from records of the United States Weather Bureau, show the amount and distribution of the valley rainfall for the past seven years:

Monthly and annual precipitation at Richfield from 1899 to 1905.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1899	0.30	0.55	4.65	0.70	T.	0.14	0.16	0.12	0.07	0.38	0.20	1.05	8.32
1900	.45	.20	0	.....	0.08	T.	0	.07	.07	.05	.30	0	.....
1901	.60	.....	1.07	.23	.10	.07	.14	.03	0	.....	.....	.74	.....
1902	.35	.65	1.35	.17	.32	.24	.18	.22	.64	.26	1.77	.47	6.62
1903	.60	.....	.57	.....	1.39	T.	.31	.30	1.00	.83	.....	.04	.....
1904	.55	.20	.16	.07	1.03	.80	.27	.37	.05	.95	0	.80	5.25
1905	.90	1.66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.28	.....
Mean	.54	.65	1.56	.29	.58	.31	.21	.19	.37	.49	.76	.56	6.73

Monthly and annual precipitation at Manti from 1899 to 1905.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1899	1.90	2.00	.....	.....	.....	.....	1.02	1.13	T.	2.38	0.31	1.30	.....
1900	.61	.25	0.10	.....	.....	0	0	.....	.....	.60	.80	0	.....
1901	.02	2.50	1.00	0.86	1.00	0.15	.22	1.23	0.08	1.05	.50	.55	9.10
1902	.52	.90	1.50	1.08	.49	.04	.26	T.	.83	.40	1.38	.86	8.26
1903	.73	1.18	1.16	1.22	2.20	.28	.53	.11	.98	1.21	.20	.40	10.26
1904	1.10	1.13	1.71	.93	2.03	.40	.61	.37	.48	.94	0	1.50	11.20
1905	.85	3.42	1.90	1.54	2.25	.05	T.	.20	3.09	.54	2.99	1.10	17.93
Mean	.82	1.63	1.23	1.11	1.59	.18	.53	.61	1.09	1.02	1.03	.95	11.35

Monthly and annual precipitation at Mount Pleasant from 1899 to 1905.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1899	1.10	3.60	2.29	0.57	1.02	0.99	0.76	1.24	0	1.80	0.88	2.10	16.65
1900	.36	.60	.10	2.56	.32	0	T.	.16	1.78	.59	1.56	T.	8.03
1901	.56	2.16	2.37	.13	.58	.29	.19	1.64	.16	1.32	.67	1.14	11.21
1902	.52	.90	1.50	1.08	.49	.04	.26	T.	.83	.40	1.38	.86	8.26
1903	1.24	1.10	1.40	1.11	1.49	.59	.56	T.	1.57	.58	.20	.20	10.34
1904	1.10	1.71	2.20	1.12	2.11	.76	1.12	.44	.36	.88	0	1.90	13.70
1905	.80	1.93	1.76	1.47	1.25	0	.17	.....	.....	0	1.15	1.10	.....
Mean	.85	1.71	1.66	1.19	1.03	.53	.51	.87	.94	.93	.97	1.22	11.37

FLOW OF STREAMS.

The streams of Sanpete and Sevier valleys are of three distinct types—the relatively long master streams, the shorter transverse tributaries, and the canals. The master streams, as already stated, meander in a gentle grade in broad waste-filled valleys of structural origin. San Pitch Creek, which is confined to the northern valley, is fed by the direct but varying flow of its tributary streams and by more constant seepage. Sevier River, on the other hand, while having similar sources of supply within the portion of its valley under consideration, is fed chiefly from sources in the high plateaus in the southern part of the State.

The tributary streams are very different. In their mountain courses they occupy narrow, steep-graded, eroded valleys, and at the base of the highlands they emerge from their canyon-like courses and enter the broad débris-filled lowland, across which they flow at a lessened grade until they join the master stream. These tributary streams are fed almost entirely by the precipitation on their mountain watersheds through direct and seepage run-off, and as the main precipitation on the mountains occurs as snow, the discharge is heaviest in late spring and early summer. Figures are not available to show the run-off of the streams in the area under discussion, but the streams in Jordan Valley under similar conditions discharge during April, May, and June about 60 per cent of the annual run-off. Besides the annual floods, occasional violent summer storms temporarily increase the discharge of the streams. Conditions are different in each watershed, the discharge varying with the precipitation,

opography, vegetation, and soils, and with the care that is taken o prevent fires, excessive grazing, and the destruction of timber. Seepage run-off is greater in valleys of relatively low relief that are bundantly clothed with vegetation, for under these conditions the roducts of rock disintegration are not readily washed into the alleys, and débris accumulates to absorb a large quantity of the recipitation, which thus escapes flood discharge and seeps slowly nto the streams, maintaining their perennial flow. Below the nouths of their canyons the tributary streams, in the upper parts of heir way across the broad valley, receive no augmentation to their ow, but, on the contrary, lose much by evaporation and absorption, hich will presently be referred to, while in their lower courses, efore they enter the main streams, their flow is generally increased y seepage. During the irrigation season the tributaries make small ontribution directly to the master streams, for their water at the nouths of the canyons is diverted by canals and distributed over the alley.

Irrigation canals tap both master streams and tributaries, the ributaries at or near the mouths of the canyons, and San Pitch Creek nd Sevier River at intervals throughout their courses, as shown n the map. Water is thus distributed over the valley where nor- ally it would not flow.

The amount of water contributed by streams to Sanpete and Sevier alleys has not been measured. An indication, however, of the dis- harge of the most important ones is afforded by the following easurements, made with a current meter by C. S. Jarvis during ne summer of 1905, but it must be borne in mind that at the time hen most of the data were collected the streams were at a low stage.

Discharge measurements of streams in Sevier and Sanpete valleys in 1905.

Stream, with place of measurement.[a]	Date.	Discharge.
		Sec.-ft.
vier River above Clear Creek	June 17	310.4
vier River near Gunnison[b]	do	51.0
vier River above Clear Creek	June 29	269.4
vier River near Gunnison[b]	do	17.0
ear Creek at mouth	June 17	119.2
Do	June 29	48.2
onroe Creek	July 11	9.3
st Creek	Aug. 4	6.3
lina Creek	Aug. 3	18.0
illow Creek	Aug. 10	1.1
elvemile Creek	do	30.7
xmile Creek	Aug. 17	16.5
anti Creek	Aug. 19	13.6
hraim Creek	Aug. 30	8.3
nal Creek	Sept. 16	3.5
k Creek	Sept. 18	4.8
dar Creek	Sept. 19	1.5
in Creek	do	8.1
easant Creek	do	8.3
rth Creek	do	1.6
ttonwood Creek at Fairview	Sept. 22	4.1

[a] If locality is not stated, the stream was measured at or near the mouth of its canyon.
[b] Estimated from gage reading.

Although the quantity of water tributary to Sanpete and Sevier valleys is not known, the amount that leaves them by San Pitch Creek and Sevier River near Gunnison has been measured for the last five years and is shown by the following tables, compiled from records of the United States Geological Survey:

Estimated discharge of San Pitch Creek near Gunnison.

Date.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
January	15	11	13.3	818
February	24	9	14.1	783
March	15	8	12.1	744
April	94	13	24.2	1,440
May	338	82	136.0	8,362
June	304	90	179.0	10,650
July	166	110	143.0	8,793
August	720	64	126.0	7,747
September	82	30	40.5	2,410
October	46	26	32.0	1,968
November	35	22	28.1	1,672
December	30	20	23.9	1,470
Total	338	8	64.3	46,860
1904	264	6	43.7	31,920
1903	158	3	37.8	27,184
1902	155	7	27.0	19,855
1901	125	9	30.0	21,808

Estimated discharge of Sevier River near Gunnison.

Date.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
January 18–31	319	254	303.0	8,414
February	573	254	318.0	17,660
March	367	87	199.0	12,240
April	92	41	67.0	3,987
May	651	41	222.0	13,650
June	525	17	164.0	9,750
July	26	17	18.4	1,131
August	69	24	32.3	1,986
September	62	41	46.2	2,749
October	101	58	89.3	5,491
November	95	87	91.4	5,439
December 1–15	116	93	98.3	2,925
Total	651	17	.....	95,009
1904	355	10	81.1	58,690
1903	366	8	.....	73,000
1902	194	5	54.0	38,677
1901 [a]	239	5	56.0	40,481

[a] Five days missing in this year.

If the figures for 1905 represent normal conditions, the flood discharge of San Pitch Creek occurs in May and June, the maximum occurring in June, after which the flow gradually decreases to the period of low water in January, February, and March, the minimum occurring in March. By comparing the total discharge of San Pitch Creek for the last five years it appears that the flow is irregular, the discharge in 1905 being more than double that in 1902. The flow of

Sevier River, which drains a much larger area, is even more irregular. In 1905 the maximum occurred in February, and the discharge in May was large, while the minimum occurred in July and August. The annual discharge varies considerably and in the dry year of 1902 was less than half that in 1905. The flow of Sevier River is much affected by irrigation, return seepage, and absorption, as is shown by the fact that on June 17, 1905, the discharge of the river below Clear Creek, at the head of central Sevier Valley, was 429.6 second-feet, while 45 miles below, at Gunnison, the discharge amounted to only 51 second-feet. Similar results were obtained on June 29.

Although figures are lacking for estimating the quantity of water available for replenishing the underground store from the flow of streams, the data given below indicate that the amount is considerable. Absorption from stream beds is, in fact, the chief source of underground water in Sanpete and Sevier valleys.

A few measurements to illustrate the amount of water absorbed from individual streams in parts of their courses were made by C. S. Jarvis in the summer of 1905, as follows:

Ephraim Creek on August 30, flowing 8.2 second-feet near the mouth of its canyon, in a course of 0.6 mile over a gravelly bed lost 0.8 second-foot, amounting to 16 per cent a mile.

Oak Creek on September 18, flowing 4.88 second-feet at a point 3 miles southeast of Spring City, in a course of 2.5 miles lost 0.46 second-foot, amounting to 3.7 per cent a mile.

Twin Creek on September 19, flowing 8.1 second-feet at a point 3.5 miles southeast of Mount Pleasant, in a course of about 2.75 miles lost 3.1 second-feet, amounting to 13.8 per cent a mile.

Moroni upper canal on September 12, flowing 6.38 second-feet, in a course of 7 miles lost 1.76 second-feet, amounting to 3.8 per cent a mile.

These figures clearly indicate the manner in which the underground supply is maintained by streams.

An instructive example of the rôle played by seepage is afforded by the flow of Sevier River between the mouth of Clear Creek and Gunnison, a distance of 45 miles. At three places between these points dams have been constructed across the river, and at each place canals divert practically all of the flow of the stream, yet below each dam the seepage into the river is sufficient to supply the next succeeding canals. This fact is illustrated by the following measurements made by Caleb Tanner in 1902, which show that between Clear Creek and Rocky Ford the flow of the river was augmented through seepage by 26.06 second-feet, between Rocky Ford and Redmond Ford by 18.2 second-feet, and between Redmond Ford and West View Bridge by 22 second-feet.

Seepage in Sevier Valley between Clear Creek and Gunnison.[a]

[Measurements made by Caleb Tanner, August 13–16, 1902.]

BETWEEN CLEAR CREEK AND ROCKY FORD.

	Sec. ft.	
Surface water entering Sevier Valley:		
Sevier River above Clear Creek	47.5	
Clear Creek	7.3	
Monroe Creek	3.9	
Thompsons Creek	.2	
Redbutte and Cottonwood creeks	.3	
Water Canyon Creek	.3	
Spring Creek	5.3	
Cove Creek	9.5	
Cedar Ridge Creek	.5	
		74.8
Surface water diverted from Sevier Valley:		
Clear Creek canal	1.38	
Joseph canal	3.85	
Wells canal	2.38	
Isaacson canal	3.03	
Monroe canal	7.25	
Elsinore canal	2.75	
Brooklyn canal	5.50	
Richfield canal	17.50	
Annabelle canal	11.18	
Candor canal	.50	
Vermilion canal	9.04	
Surface water leaving valley:		
Sevier River	36.5	
Total diverted and remaining in stream		100.
Seepage		26.

BETWEEN ROCKY FORD AND REDMOND FORD.

Surface water entering Sevier Valley:		
Sevier River at Rocky Ford	36.5	
Lost Creek	.7	
Salina Creek	7.8	
		45.
Surface water diverted from Sevier Valley:		
Rock Ford canal	35.0	
Other canals	8.5	
Surface water leaving valley:		
Sevier River	19.7	
Total diverted and remaining in stream		63.
Seepage		18.

[a] Water Sup. and Irr. Paper No. 85, U. S. Geol. Survey, 1903, pp. 91–94.

BETWEEN REDMOND FORD AND WEST VIEW RIDGE.

	Sec. ft.	
rface water entering Sevier Valley:		
Sevier River at Redmond Ford	19.7	
Willow Creek	.5	
San Pitch Creek	15.2	
		35.4
rface water diverted from Sevier Valley:		
Robbins canal	8.14	
Westview canal	4.20	
Other canals	15.70	
rface water leaving Sevier Valley:		
Sevier River	18.7	
Dover canal	10.7	
Total		57.44
Seepage		22.04

OTHER SOURCES.

The undergrown water supply of Sanpete and Sevier valleys is ugmented not only by rainfall that is directly absorbed by the sur- ace on which it falls and by absorption from creek beds, but also y the flow of springs from bed rock, by the return waters of irri- ation, and by the underflow from the creeks at the mouths of their anyons.

The occurrence of springs is described on pages 25–26, but it should e noted here that, in addition to many seeps, a number of springs that ssue along fault lines convey water to the valley from a distant ource in bed rock. The total discharge of these fault springs mounts to a constant flow of about 95 second-feet, and absorption f a part of the flow adds an appreciable amount to the underground aters.

In the practice of irrigation part of the water applied to the fields s absorbed by the soil and, percolating below the reach of roots and eyond the sphere of capillary action, joins the underground supply. he amount thus absorbed varies considerably from place to place, epending on the porosity of the soil and the quantity of water pplied to the fields in excess of the need.

The underflow of the creeks at the mouths of their canyons also ontributes an important quota to the underground supply of the alleys. No data are available to show this amount, but it can be etermined by measuring the cross-section of the valley filling, its orosity, and the velocity of the underflow.

DISTRIBUTION OF UNDERGROUND WATER.

Underground water, derived from the sources that have been tated, is contained in both the unconsolidated deposits and the bed ocks of Sanpete and Sevier valleys. The former are the more valu-

able reservoirs, but some of the consolidated deposits also are important. All rocks, even the most dense, are to a certain extent porous, and the great mass of underground water is contained in rock pores and interstices. Fine-textured, compact deposits are relatively of little importance as water carriers, the chief reservoirs being the loose-textured, more permeable rocks.

WATER IN BED ROCKS.

As has been indicated in the preceding description of the rocks of this region, the general character of several of the formations renders them of little value as underground reservoirs. The massive, fine-textured igneous rocks, except locally, where they are cracked, are practically worthless in this connection; so, too, are the Jurassic shales. The strata of known Eocene age, which occupy a large area, composed as they are of close-grained shale and limestone and thin lenses of sandstone, have also little value for absorbing and transmitting water. On the other hand, the sandstone of probable Laramie age that outcrops on the Wasatch Plateau and the conglomerate and sandstone of undetermined age on the Pavant Mountains are probably important water-bearing beds, although they have not been developed. These porous strata are of considerable thickness and outcrop on large areas in the mountains where the opportunities for absorption are good. They are overlain by relatively impervious beds and dip toward the valley. The conditions for obtaining artesian water in the valleys are therefore favorable, except where there are disturbing factors, presently to be stated.

The geologic map and sections (Pls. II and III) show that the Laramie sandstone occupies many square miles on the summit and western flanks of the Wasatch Plateau east of Sanpete Valley, extending as far south as Salina Creek, and that toward the base of the plateau the sandstone is capped by shales and limestones of Eocene age. The dip is westward—toward the valley—at angles ranging from 5° to 20°. At the base of the highlands, however, the rocks are concealed by unconsolidated deposits, and little information is available concerning the position of bed rock beneath the valley filling. At the southern end of the Wasatch Plateau the western flank is broken by several north-south trending faults, which fade away northward, and none are known to extend beyond Manti Creek. No evidence of faulting at the base of the plateau has been obtained in the northern and central parts of Sanpete Valley, where the rocks that are exposed along the flanks of the plateau probably continue unbroken beneath the valley nearly to its western limit. The western dip, if continued beneath the valley at the same angle, would carry the water-bearing beds beyond the reach of profitable drilling.

Springs

(bers refer to lists of wells and springs)

Scale

2 3 4 5 6 miles

S AND SPRINGS

but the rocks in the ridge between Fountain Green and Mount Pleasant lie almost flat, and this fact suggests that the dips flatten out and cause the sandstone to occur possibly within profitable reach of the drill. Its position, however, can be determined only by prospecting.

The map (Pl. II) also shows that a large area on the crest and eastern flanks of the Pavant Mountains is occupied by a great thickness of coarse conglomerate and sandstone, which are advantageously located to absorb water directly from precipitation and from the flow of streams. These coarse-textured rocks are overlain by relatively impervious strata and dip gently toward the valley. They are, however, cut by the fault which extends along the eastern base of the mountains, and which, by intersecting water-bearing beds, is an important factor in connection with the water supply, as noted on page 14. The character and position of bed rock beneath Sevier Valley are unknown, and the presence of this fault makes the chance of obtaining artesian water from this source less favorable in Sevier than in Sanpete Valley.

WATER IN THE VALLEY DEPOSITS.

Water absorbed at the surface percolates downward for a greater or less distance through the unconsolidated valley deposits until it reaches the zone of saturation. The upper surface of this zone is known as the water table, beneath which the deposits are saturated, the water occupying the spaces between the solid particles of gravel, sand, and clay. In Sanpete and Sevier valleys the position of the water table conforms in a general way with the contour of the valley floor. Beneath the broad lowlands the water table slopes at a low angle upstream, away from the central valley axis, but near the highlands the slope of the surface of saturation is less than the inclination of the ground. As a result, the ground water in the lowlands lies close to the surface, and near the base of the mountains it lies at considerable depths. In the town of Mount Pleasant, for instance, the slope of the ground is about 170 feet to the mile, while the inclination of the water table is about 95 feet to the mile.

In the absence of adequate topographic maps on which the position of the water table could be shown by contours, the approximate depth to ground water is shown on Pls. V and VI by lines representing areas in which ground water lies, respectively, at depths between 0 and 10, 10 and 50, and over 50 feet beneath the surface. This information was compiled from the well data given on pages 51–57, which, with the location of the wells shown on the map, serve as an index to the available knowledge. Under much of the area in which the depth to ground water is shown as over 50 feet water can

not be obtained within 100 feet or more, but it is impracticable to indicate on the map more than is shown.

The position of the water table fluctuates measurably. It is highest in summer, after the period of heavy stream discharge and during the irrigation season, and lowest in winter, when there is comparatively little addition to the underground supply. A fluctuation of 20 feet has been observed in some wells, and variations between 2 and 10 feet are common between the summer maximum and the winter minimum. The use of ground water tends to lower the water table, but in the area under consideration persistent decrease has not yet been marked, though in places, as in the fields below Manti, a loss of head has followed the sinking of many shallow wells. Locally in the lowlands there has been a permanent rise in the level of ground water, due to the return waters of irrigation, whereby former fertile tracts have been converted into meadow and swamp lands.

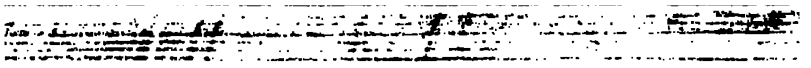
The saturated beds contain varying amounts of water, their content depending on the character, thickness, and extent of the deposits. Coarse-textured gravel and sand, by reason of their greater porosity, hold and transmit relatively more water than fine-textured clay, and the coarser deposits therefore constitute the chief underground reservoirs. The wells that have been sunk in this region encounter beds of sand and gravel that range in thickness from a few inches to many feet and are separated by beds of clay of varying thickness. Locally these water-bearing beds have considerable horizontal extent, and, although the details of their distribution are not known, experience in sinking wells has shown that beds of sand and gravel are of widespread occurrence, both horizontally and vertically.

Underground water is seldom stationary, but moves very slowly from a higher to a lower level. The velocity varies with the head and with the number and size of the interstitial spaces, for the movement is not in open channels, but through the minute pores between the solid particles of the deposits. The rate of movement is only a few feet a day. The highest velocity of ground water that has been recorded is about 100 feet in twenty-four hours, and generally it is much less, the ordinary rates in sand being between 2 and 50 feet a day.

RECOVERY OF UNDERGROUND WATER.

The total amount of underground water in Sanpete and Sevier valleys, if it could be computed, would be expressed in cubic miles, but, by reason either of its depth or through its inclusion in fine textured deposits, which do not readily yield their content, a large part of the subterranean store is not available. An estimate of the available amount is also impracticable because of the unknown extent

S AND SPRINGS



f the irregular lenses of sand and gravel which constitute the im-ortant reservoirs. But, although figures can not be given, it is vident that a considerable supply of underground water awaits evelopment in this area.

RECOVERY OF WATER FROM BED ROCKS.

Bed rocks are an important, but little developed, source of water in his area. A number of large springs originate in these consolidated eposits, and conditions for obtaining artesian wells are locally avorable.

RECOVERY OF WATER FROM BED ROCK BY SPRINGS.

Springs are a source of much water in Sanpete and Sevier valleys, 8 being recorded on pages 58–60. These can be classed either as ault springs or seep springs, the water from the first class issuing long a fault plane, that from the second class seeping out, generally ı low areas, where the surface intersects the ground-water table.)f the 88 that are listed 30 are fault springs, yielding an aggregate ischarge of 95 second-feet. Fault springs have their sources in bed ocks and commonly are located at the base of the mountains, along ıe principal planes of dislocation, prominent groups being on the astern margin of Sevier Valley and on the western margin of anpete Valley, although isolated springs occur at a number of other laces, as shown on the map. The discharge of fault springs varies ttle, if any, throughout the year; each spring commonly yields as ıuch as 1 second-foot, the mean of all being over 3 second-feet, and ne west of Fountain Green flows 12.4 second-feet. (Pl. IV, A.)

The temperatures of these springs differ greatly. That of many is nly a few degrees above the mean annual temperature of the valleys, bout 48°, but some are distinctly hot, Joseph Hot Springs (No. 3 in ist on p. 58 and on Pl. V) ranging from 135° to 156° F. and Monroe Hot Springs (No. 5) ranging from 144° to 156° F. The temperature f some of the hot springs is probably due to the proximity of heated gneous rocks. That of others, as Richfield Spring (No. 71), which s 74° F., appears to be due to the internal heat of the earth, although he possible influence of igneous rocks must not be ignored. If the emperature of the Richfield Spring be due entirely to the normal ieat of the earth, an index is thus afforded of the depth of the water efore it rises. If an increment of 1° F. for each 50 feet be assumed vithout allowance for cooling, a depth of 1,300 feet is indicated.

The general occurrence of fault springs, although each one differs rom others in details, may be illustrated by the Richfield Spring. See fig. 3.) Here the porous conglomerates and sandstones that out-

crop on the Pavant Mountains dip toward the valley and are overlain by the relatively impervious Wasatch beds. The mountains have been uplifted along the fault at their base, and the water-bearing beds—the conglomerate and sandstone—have been cut by the dis-

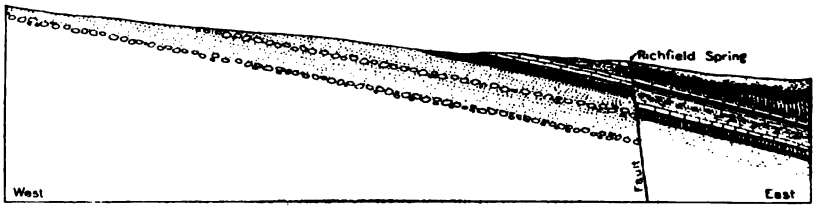


FIG. 3.—Diagrammatic section at Richfield Spring.

placement as if by a well. In consequence the water, which is under pressure, rises along the fault plane, the place of actual issue being determined by a series of favorable conditions by which free passage is maintained.

RECOVERY OF WATER FROM BED ROCK BY TUNNELS.

The practicability of tunneling into fault planes to obtain water is suggested by the occurrence of springs along lines of displacement, and a notable successful tunnel is that of the Morrison coal mine east of Sterling. This tunnel was begun on a dry hillside and driven eastward toward the fault, which has not yet been reached. Water was encountered which in August, 1905, was found to discharge 5.6 second-feet. The probable conditions here are shown by fig. 4. The source appears to be in the westward-dipping sandstone that outcrops on the Wasatch Plateau. The water being under hydrostatic pres-

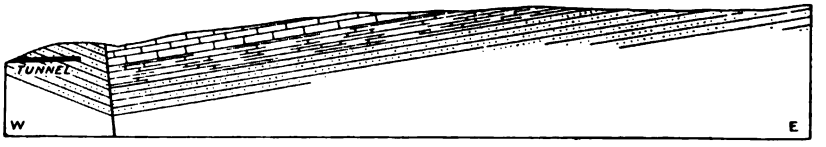


FIG. 4.—Diagrammatic section at Morrison Tunnel Spring.

sure, rises when it reaches the fault plane. Notwithstanding the success of this tunnel, similar results can not be generally predicted, because of the ever-present possibility of unfortunate conditions, such as cementation along fault planes and easier escape of the water in other directions. Yet tunneling into fault planes along which strong springs occur presents possibilities that would seem to justify prospecting.

Tunnels may be advantageously driven not only into fault planes, but possibly elsewhere, for it may be profitable to explore locally the

base of the mountains where water-bearing beds dip valleyward, as in the Pavant Range and on the Wasatch Plateau, with the idea of penetrating saturated strata by tunnels instead of wells.

RECOVERY OF WATER FROM BED ROCK BY WELLS.

With the exception of well No. 237 (see list on p. 56, and map forming Pl. VI), between Mount Pleasant and Fairview, no wells, as far as the writer is informed, have been sunk to bed rock in Sanpete and Sevier valleys. Nevertheless flowing wells may possibly be obtained from consolidated rocks in certain areas as already suggested, the most promising sources being the eastward-dipping conglomerates and sandstones on the Pavant Mountains and the westward-dipping sandstone on the Wasatch Plateau.

Steep dips and faults are locally disturbing factors, but the conditions warrant sinking test wells.

In the center of Sevier Valley, on account of the faulting, it is possible that the water-bearing beds lie at depths too great for profitable wells, since the temperature of the Richfield Spring indicates a depth of 1,300 feet to the water beds at the border of the valley. Preliminary tests might be made west of the fault in valleys where streams have cut deep into the rocks.

Conditions for flowing wells are more favorable in Sanpete Valley, especially between Fairview and Spring City. The absence of faulting has not been proved here, but the westward-dipping rocks of the Wasatch Plateau may extend unbroken beneath the valley, where the dips probably flatten out. If these conditions actually prevail it is likely that profitable flowing wells can be obtained from the Laramie sandstone. Because of the uncertainty of the dip and the variable thickness and unknown erosion of the Eocene strata depths can not be predicted, but before a test well is abandoned it should be sunk until the Laramie sandstone is reached.

RECOVERY OF WATER FROM VALLEY DEPOSITS.

The source of most abundant underground water in Sanpete and Sevier valleys is the unconsolidated material by which they are underlain and from which water is recovered by springs, tunnels, and both flowing and nonflowing wells.

RECOVERY OF WATER FROM VALLEY DEPOSITS BY SPRINGS.

Although most of the fault springs issue through unconsolidated deposits, their origin is obvious and they should not be confounded with seep springs. As already stated, springs of the first class occur along faults. Those of the second are independent of structure and commonly occur in lowlands where the surface of the ground inter-

sects the water table. The discharge of seep springs is generally unlike that of fault springs, since it often fluctuates with the season instead of flowing almost constantly. The temperature of fault springs is also more constant, and is commonly higher than that of seep springs, a fact that is especially apparent during the winter.

Seep springs are numerous in Sanpete and Sevier valleys, especially in their lower stretches, and the important part played by seepage in maintaining the flow of the streams has been already noted. Seepage is so widespread and in any one spot is usually so slight that over large areas it is impracticable to map places of exit of seepage water, but points where the flow appears in springs and is concentrated into considerable streams are shown on Pls. V and VI and are listed on pages 58 to 60. The flow of many seep springs can be increased by development, but some of them are at elevations so low that their waters are unavailable for use in the immediate vicinity except by pumping.

RECOVERY OF WATER FROM VALLEY DEPOSITS BY TUNNELS.

Tunnels driven into the unconsolidated deposits have procured large amounts of water. Especially favorable sites for tunnels are places where the low lands begin to raise at an increased angle toward the base of the mountains. At such places the ground water tapped

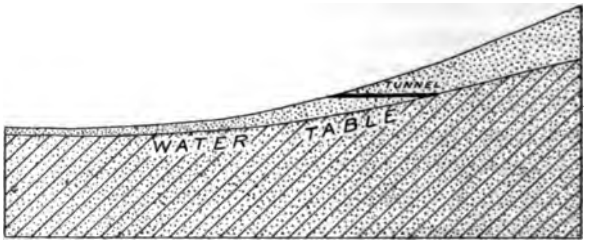


FIG. 5.—Section illustrating a tunnel in the valley deposits.

will drain by gravity into tunnels, as illustrated in fig. 5. A tunnel of this class is that of Madsen and Seely, west of Mount Pleasant. (See p. 49.)

RECOVERY OF WATER FROM VALLEY DEPOSITS BY NONFLOWING WELLS.

Nonflowing wells, the general features of which are indicated in the list, pages 51–57, are the most common means of recovering underground water in Sanpete and Sevier valleys. The maps show that ground water lies within 10 feet of the surface under a large part of the valleys, this area of course being in the lowlands, and that toward the highlands the depth increases. The nonflowing wells are commonly dug beneath the ground-water level to a porous bed of sand or gravel, from which water percolates into the opening. Most of

the wells are sunk several feet below the summer stage of the water table in order to provide for the seasonal fluctuation. There are also a number of nonflowing bored wells, which have been put down with the hope of obtaining a flow at the surface.

Water is drawn from most of these wells by buckets or hand pumps. A few windmills are in operation, but the wind velocity is apparently not great or steady enough to give them general favor. There are few, if any, power pumps in the valley, which affords a promising field for their introduction and their use in irrigation. Water contained in coarse beds, which insure an abundant yield, lies within easy reach of the surface beneath large areas, and electric power can be cheaply developed from the near-by mountain streams.

RECOVERY OF WATER FROM VALLEY DEPOSITS BY FLOWING WELLS.

The irregular sheets of gravel, sand, and clay that slope valleyward from the base of the mountains afford conditions favorable for pressure in their contained water. Accordingly, where beds of sand and gravel that lie below a confining stratum of relatively impervious material are encountered by wells which enter the zone of saturation, the water tends to rise in the wells, and in the lowlands sufficient head is developed to cause flows at the surface. Above the lowlands on each side of the valley the water in deep wells rises a greater or less distance, the height it reaches depending upon the elevation of the ground.

It is estimated that there are more than 100 flowing wells in the two valleys, yielding an aggregate flow of about 5 second-feet. Most of the wells are 1½ or 2 inches in diameter, but a few of the larger ones are 3 or 4 inches. Flows are obtained at different depths between 20 and 344 feet, under pressures at the surface varying from 0 to 6 pounds per square inch. The average yield of the wells is possibly about 20 gallons a minute, but the range is wide, several discharging less than 1 gallon a minute. The greatest flow measured was 160 gallons a minute, from a 3-inch pipe. Beneath the first flow other flows are commonly obtained from each bed of sand and gravel encountered in boring the well.

The flowing wells are located in the fields below the towns, which generally are built at elevations so high that the water of the wells is little used for domestic purposes, for which, by its purity, it is eminently adapted. It is used to some extent for watering stock, but chiefly for irrigation.

The use of artesian water from the valley deposits has only begun, and the possibilities apparently are not realized. There is need for a number of test wells to exploit conditions in the lower deposits, and where good flows are obtained more wells of larger bore may profitably be sunk.

RECOVERY OF WATER FROM VALLEY DEPOSITS BY SUBSURFACE DAMS, ETC.

Under exceptional conditions ground water may be recovered by means of subsurface dams or similar contrivances which impound the underflow in unconsolidated materials. These conditions are practically impervious bottom within easy reach of the surface, to prevent excessive lowering of the ground-water level, and competent side walls, not too far apart, to intercept lateral escape. The presence of these conditions can be determined only by prospecting, and the economic desirability of building such structures at particular places is an independent question, but because of the high value of water in this area their feasibility at each possible site should be investigated. Possible locations of subsurface dams are suggested by rock walls at the mouths of the narrow canyons, where borings in search of suitable bottom should be made. Tests of the amount and porosity of the valley filling at and above the mouths of the canyons, together with measurements of the velocity of the underflow, would indicate the quantity of ground water available. At some places below the mouths of the canyons in the several creek valleys conditions favorable to the construction of infiltration galleries may also be discovered.

QUALITY OF WATER.

Few analyses have been made of the waters of Sanpete and Sevier valleys, although their general character is indicated by a number of field tests. During the summer of 1900 the Bureau of Soils[a] examined the waters of Sevier Valley, and in the fall of 1905 the writer made the following field assays, using the methods suggested by Mr. M. O. Leighton.[b] The figures given represent only approximate composition; yet, as all the tests were made under similar conditions, they afford rough comparative data:

Field assays of water from Sanpete and Sevier valleys, Utah.

[Parts per million.]

Name and locality.	Calcium (Ca).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4).	Chlorine (Cl).
STREAMS.				
Pleasant Creek[c]	238	234	− 35	6
Manti Creek[c]	238	204	157	Trace.
San Pitch Creek, west of Mount Pleasant	890	408	237	45
San Pitch Creek, east of Gunnison	550	408	492	519
Sevier River, west of Gunnison	1,150	877	+626	1,015
Sevier River, west of Joseph	261	.....	80	29
Sixmile Creek[c]	360	245	65	19
Twelvemile Creek[c]	505	.....	76	19
Upper Salina Creek, 7 miles above mouth of canyon	410	245	113	9

[a] Soil survey in Sevier Valley, Utah, Rept. field operations Division of Soils, U. S. Dept. of Agriculture, 1900.

[b] Leighton, M. O., Field assay of water: Water-Sup. and Irr. Paper U. S. Geol. Survey No. 151, 1905.

[c] Samples obtained at mouths of canyons.

Field assays of water from Sanpete and Sevier valleys, Utah—Continued.

Name and locality.	Calcium (Ca).	Bicarbonate radicle (HCO_3).	Sulphate radicle (SO_4)	Chlorine (Cl).
STREAMS—continued.				
Lower Salina Creek[a]	151	265	127	119
Monroe Creek[a]	96	102	− 35	9
Dry Creek[a]	248	.....	53	9
SPRINGS.				
Fountain Green (No. 86)[b]	(c)	265	0	19
Morrison tunnel (No. 38)	410	326	164	29
Ninemile (No. 34)	435	367	459	308
Glenwood (No. 12)	96	122	0	24
Richfield (No. 16)	228	265	Trace.	29
FLOWING WELLS.				
Allred	380	408	492	297
Seeley	274	204	− 35	258
West of Manti	274	367	135	14
Between Fairview and Mount Pleasant	274	286	− 35	19
Bolitho	340	326	74	59
Brooklyn Irrigation Co	595	326	530	498
DUG WELLS.				
Fairview (Bohney House)	715	367	− 35	19
Salina (White House)	595	510	135	218
South of Salina (Colby)	320	204	108	109
Ephraim (S. Sorensen)	1,150	551	+626	148
Moroni (Moroni House)	650	367	300	258
Ephraim (Ephraim House)	274	449	62	59
Gunnison (Gunnison House)	248	571	572	636

[a] Samples obtained at mouths of canyons.
[b] Numbers are those given on Pls. V and VI.
[c] Calcium content very large.

The general composition of the waters of the area under consideration can be inferred from the outline of the geology of the watershed, for the mineral content of surface and ground waters is determined by the chemical character of the rocks and soils with which they come in contact. (See pp. 8–14.) The prevalence of limestone causes an abundance of carbonates; the waters which come under the influence of the Jurassic salt and gypsum bearing rocks are rich in chlorides and sulphates; while streams like Monroe Creek, which traverse igneous rocks, carry relatively little mineral matter in solution. Water from wells of moderate or considerable depth is usually similar to that of the mountain streams in the same locality, but that from shallow wells in the lowlands, especially in irrigated tracts, contains abundant dissolved salts. This mineral content is largely derived from the return waters of irrigation, which leach the soils, for in the lowlands where ground water is within reach of capillary action the dissolved salts are deposited by evaporation and the soil is impregnated with an accumulation of "alkali." The combined deleterious effects of the soluble Jurassic rocks and of the alkali in the lowlands is shown in the table by the two tests of the water of Sevier River. The sample collected west of Joseph, in the upper part of the valley, contained only 261 parts per million of calcium, 80 sulphates, and 29 parts of chlorines, while the sample from the

same river west of Gunnison contained 377 parts of bicarbonates, 1,150 parts of calcium, over 626 parts of sulphates, and 1,015 parts of chlorine.

The natural conditions are generally favorable for obtaining good water for domestic purposes, but the communities give little heed to the sanitary character of the water, and as a result epidemics of typhoid fever of greater or less violence are not uncommon. As ordinary hygienic precaution will prevent most of such epidemics the negligence in providing pure water supplies can not be too strongly condemned. Ill-kept privies and cesspools are nuisances that should not be tolerated in settled communities. Privies should be replaced by "dry-earth closets," provided with a supply of dry clay loam, and the fecal matter should be removed at short intervals. Where there are public water supplies it is desirable that sewers should also be installed and the sewage might, if desired, be used in irrigation on "sewer farms." The local custom of using old wells as cesspools pollutes the water of neighboring wells that are still used as sources of drinking water, and should be prohibited. Another prevalent unsanitary custom is the use, for drinking and cooking, of water running through the towns in open ditches, into which pollution is free to drain.

All the towns in the area except one or two can procure water supplies either from springs or from mountain streams, which with care can be protected from contamination, and outlying houses can be supplied with water from deep wells. But although pure water can easily be obtained, only four towns in Sanpete and Sevier valleys—Freedom, Mount Pleasant, Manti, and Richfield—have public waterworks.

SUGGESTIONS.

In view of the present undeveloped state of the ground waters of Sanpete and Sevier valleys and the need of more water, a few suggestions as to a more efficient use of the available resources may be pertinent.

As the only source of water is the precipitation on the drainage area tributary to the valleys, it is clear that attention should be given to conserving this supply by preventing waste whenever possible. The chief problem is to save the storm waters, and to this end large storage reservoirs have been built or planned, but it does not appear to be generally realized that the storm run-off can be saved also by other means. The underground supply can be considerably augmented by distributing the flood discharge over the uplands below the mouths of the canyons of the creeks that emerge from the mountains. The control of floods is difficult, but by placing obstructions in the ordinary channels flood waters can be spread over a wide area, so as to increase greatly the amount of water that is absorbed in the

porous alluvial deposits. Small reservoirs can also be constructed at many places within the mountain watershed, whereby the storm run-off can be checked and the seepage run-off in the dry season increased. The advantage of preserving timber on the mountains should also be clearly understood. A drainage area well covered with vegetation is one of the most effectual checks to storm run-off. A heavy growth of underbrush and trees tends to prevent storms from washing away the products of rock decay and to accumulate a thick cover of soil and humus, which absorbs large quantities of water from storms and from melting snow, whereas if the covering of vegetation is scant, storms tend to keep the mountain sides relatively bare of soil by washing the débris into the creeks, so that the precipitation runs off rapidly and comparatively little is absorbed to seep slowly into the creeks to maintain their summer flow. The timber should therefore be protected from fire and from reckless cutting, excessive grazing should not be permitted, and trees might be planted to advantage in many areas.

Not only should the supply be conserved as far as possible, but more efficient use of the available water should be practiced. Much is lost by crude methods of irrigation. More water is often applied to the fields than is needed, and a large part is lost by seepage from faultily constructed ditches. The use of pipes whenever practicable and the construction of less permeable canals would prevent much waste. Much water is also lost by allowing artesian wells to flow constantly. It should be thoroughly realized that the limited supply of ground water comes from a common source, that the wastefulness of one person counteracts the prudence of another, and that the interest of all demands that the supply be rigorously conserved. Flowing wells should be capped, or the flow should at least be partly checked when water is not used, or the water should be collected in reservoirs for future use. A further incentive to economy in the use of water is the fact that by its conservation the evil of alkali accumulation and the raising of the water table too near the surface in the lowlands is retarded.

The distribution of underground water suggests that the most efficient use of the total supply in the valley would be to develop the fertile uplands toward the base of the mountains, as far as may be, from high-line canals, supplied by the mountain streams; and to use underground water, which in general is inaccessible on the uplands, in developing the lowlands, where the subterranean supply is plentiful. Owing to the present complicated ownership of water rights, it may be difficult to act upon this suggestion, but there can be no doubt that its adoption would materially add to the amount of land under cultivation. Flowing wells can be obtained in large areas

in the lowlands, and at several localities where coarse water-bearing sand and gravel occur near the surface there is a possibility of establishing pumping plants, for which electric power developed from the adjacent mountain streams is generally available. It should be remembered, however, that although the underground supply is considerable, it must not be recklessly used. Observations on the fluctuation of the water table should serve as a guide to development.

Since the underground water supply in Sanpete and Sevier valleys is but little developed and local conditions are promising, further testing of the resources is very desirable. Deep wells should be sunk in both valleys to ascertain the conditions in the unconsolidated deposits, and to determine whether flowing wells can be obtained from bed rock. Where good supplies are found pipes of larger bore than those now used might well be employed. Also the flow of some of the springs can be materially increased by development, and possibly new ones found by prospecting.

DETAILED DESCRIPTIONS.

The descriptive details that follow are supplementary to the information contained in the maps forming Pls. VI and VII and the list of wells and springs on pages 51–60. The descriptions begin at the south and proceed northward, the areas described being grouped about the principal towns.

JOSEPH AND VICINITY.

About 6 miles south of Joseph the Sevier River emerges from a canyon and flows northeastward between the lava-capped foothills of the Pavant Mountains and a low ridge of igneous rocks. The town of Joseph is situated near the base of the long alluvial slope west of the river. Water for irrigation is furnished by the Sevier Valley canal, below which most of the land is under cultivation, and drinking water of poor quality is obtained from shallow dug wells. Most of the area lying below the canal is underlain by gravel and by subordinate streaks of sand and clay; ground water lies within 50 feet of the surface, and the wells are between 30 and 60 feet in depth. The annual fluctuation of the water surface amounts to about 10 feet, the water being highest in midsummer and lowest in late winter, when some of the wells go dry. A better supply for drinking purposes probably can be obtained from bored wells near the river, 100 feet or more in depth. These would avoid contamination and at least some seepage from the canals. There is little likelihood of profitably obtaining underground water for irrigating the arid slope west of Joseph, although it is possible that deep wells after penetrating a considerable but unknown thickness of lava and

the underlying Eocene strata, would strike artesian water in the underlying sandstones and conglomerates.

The Joseph Hot Springs issue from calcareous tufa, deposited by the springs, at the base of the low volcanic ridge about a mile southeast of the town. The temperature of the water ranges from 135° to 146° F., and the yield of all is estimated to be only about 30 gallons a minute.

ELSINORE AND VICINITY.

Sevier Valley broadens out a few miles above Elsinore, which is located in the midst of a prosperous agricultural district. Contiguous to the river, particularly south of it, a number of shallow wells have been dug, from which an abundant supply of water in coarse gravel is obtained at depths ranging from 20 to 35 feet. Two wells have been bored in this area, one, 178 feet deep, in the SE. ¼ sec. 32, T. 24 S., R. 3 W., the other, 171 feet deep, in the SW. ¼ sec. 34, in the same range and township. In sinking these wells the surface was found to be underlain chiefly by sand and gravel to a depth of 150 feet, where stiff yellow clay was encountered, through which the inadequate apparatus failed to penetrate. This immediate area is favorable for testing underground conditions, and it is desirable that a deep well be sunk here to determine the possibility of obtaining flowing wells in the valley deposits. The discharge of Monroe Creek, on the southeast, and the seepage from Sevier River in its sandy course below the mouth of its canyon are sources of an underground supply which may be under pressure in possible coarse deposits beneath the clay above mentioned. If flowing wells should not be obtained, pumping from the shallow gravels is an attractive possibility.

Midway between Joseph and Elsinore, near the river, in SE. ¼ sec. 6, T. 25 S., R. 3 W., there is a group of about 25 wells, in which the water rises within 2 or 3 feet of the surface. These are 1½ inches in diameter and less than 50 feet deep and the yield of all amounts to about 1 second-foot. Trenches have been dug, in which the flow is conducted to the Brooklyn canal. Clay was encountered in these wells down to 12 feet, below which water-bearing sand and gravel occur.

The town of Elsinore is built on an alluvial slope at the base of lava-capped foothills. Water for irrigation is obtained from several canals that are fed by Sevier River, and these also furnish an unsatisfactory domestic supply, which is supplemented by a few poor wells between 60 and 115 feet in depth. The chief desideratum is a good supply for domestic purposes. Possible sources are a number of feeble seep springs in the hills a few miles to the northwest, springs on the east side of the valley adjacent to Thompsons Creek,

Monroe Creek, and wells. Although capable of development, the yield of the springs first mentioned appears to be insufficient; on the other hand, surface water of good quality and abundant quantity is available on the eastern side of the valley, but its use necessitates a pipe line extending several miles. The project of sinking wells, however, offers attractive possibilities. These are of two distinct classes, deep wells in the valley deposits and wells sunk to bed rock. The desirability of sinking a test well in the valley south of Elsinore has just been mentioned. It can hardly be expected, even if a flow should result, that the pressure would be sufficient to carry the water to Elsinore, yet it is probable that water of good quality can be thus obtained. Another possibility is to tap the sandstones and conglomerates that cap the Pavant Mountains and dip southeastward. The fault along the base of the mountains complicates the situation and makes it desirable that the first experimental well be drilled west of it. Another disturbing factor in the vicinity of Elsinore is the cap of hard lava. This, however, can be avoided by sinking a well in the valley about 2 miles north of the town. The surface strata will probably yield water of poor quality, but this could be cased off, for good water under pressure is to be expected from the underlying beds. The depth at which water will be found can not be predicted, but the beds that overlie the water-bearing strata are probably several hundred feet thick, and if exploration is undertaken at all preparations should be made to sink a well at least 1,000 feet deep.

MONROE AND VICINITY.

Monroe is prettily situated on an alluvial slope on the east side of the valley, at the base of the Sevier Plateau. Monroe Creek, the principal source of water supply, flows throughout its course over crystalline rocks, and its water therefore contains relatively little dissolved matter. In this respect it is the purest large stream in the entire area here considered. A number of canals, fed from Sevier River and Monroe Creek, furnish water for irrigation, and these canals are also largely resorted to for domestic supply. In view of the fact that excellent water is available in Monroe Canyon, it is surprising that the community is willing to continue using for household purposes the present relatively unsanitary supply. The depth to ground water is over 50 feet, and there are but few wells in Monroe.

The hot springs near Monroe are a valuable asset, but as yet they are little used. There are several groups of springs a half mile east of the town along a probable fault line at the base of the mountains, which are composed of igneous rocks. The salts held in solution by the water are deposited as tufa, from which springs now issue at a number of places. The total yield is about 100 gallons a minute, and

the temperature of the water when it reaches the surface ranges from 144° to 156° F. The proximity of the springs to the town suggests the desirability of attempting to increase their flow with the idea of utilizing the heat.

The following analysis of the water of Cooper Hot Springs was obtained from the owner:

Analysis of water from Cooper Hot Springs, east of Monroe (No. 5).

[Analyst, P. A. Yoder.]

	Parts per million.
Ca	267.7
Mg	35.1
Na	591.4
K	37.5
Li	.6
Fe, Al	0.0
SiO_2	23.5
SO_4	167.6
CO_3	36.0
Cl	634.6
Total solids	1,794.0

The few wells that have been sunk in the valley southwest of Monroe show that the depth to ground water is over 70 feet. The most practicable way, therefore, of developing the area is from high-line canals supplied by Sevier River and Monroe Creek.

The presence of several springs between 1 and 3 miles south of the mouth of Monroe Canyon, along a probable fault, suggests that more water may be obtained by tunneling.

RICHFIELD AND VICINITY.

The portion of Sevier Valley between Monroe and Richfield that lies below the canals is in large part under cultivation, but the portion above them consists of desert alluvial slopes that extend up to the bases of the mountains. In the highlands bowlders and coarse-textured débris abound, while the lowlands are floored with sand and clay loam. The map forming Pl. VI shows that ground water lies within 10 feet of the surface under a considerable part of the lowlands, and that in this vicinity there are about 100 artesian wells, concerning which representative data are given in the list on pages 51–57. They are shallow, ranging from 50 to 95 feet in depth, and yield from 3 to 142 gallons a minute under a pressure at the surface of slightly over 2 pounds. In drilling, clay is usually encountered for 40 to 60 feet, below which lies said and gravel, whence the flows are obtained. The gravel appears to be widely distributed and constitutes a valuable reservoir. By a single well, No. 59, in list on page 52 and map (Pl. V), which is 4 inches in diameter, 62 feet deep,

and yields 132 gallons a minute, a large tract of alkali land has been converted into an excellent meadow.

The deepest well in this vicinity was sunk in 1900 in NE. ¼ sec. 7, T. 24, S., R., 2 W., to a depth of 324 feet. The log of this well, as reported by the owner, is given below:

Log of well in sec. 7, T. 24 S., R. 2 W., in feet.

	Thickness.	Depth.
Clay	62	62
Sand and gravel	88	150
Clay	15	165
Sand and gravel	135	300
Clay	20	320
Sand and gravel	24	344

From the upper beds of sand and gravel in this well water rose within a few inches of the surface and a flow was obtained from the bottom, but the pipe broke and the well was discontinued. So far as known, this is the deepest hole in Sevier Valley proper, and the results serve to emphasize the desirability of a deep test well. The probabilities are that such a well will penetrate one or more beds of sand and gravel, bearing water under pressure great enough to cause flows at the surface, even if the well should be sunk at some distance from the river.

Not only the valley deposits, but the bed rock is an available source of underground water, especially along the base of the mountains, near Richfield. The considerable outcrop of sandstone and conglomerate on the crest and eastern flanks of the Pavant Range, as already stated (p. 23), presents a large area for the absorption of precipitation and run-off, and the eastward dip and cap of Eocene strata cause the contained water to be under pressure. Although deep valleys drain a large portion of the porous rocks, it is nevertheless likely that a well sunk through the capping of limestones and shales will strike artesian water in the underlying sandstone and conglomerate. The fault along the base of the mountains is a disturbing factor, yet apparently it is the cause of the spring west of Richfield, and thus serves to emphasize the possibility of obtaining water under pressure. The depth at which water may be expected can not be closely predicated. If a test well is attempted provision should be made for driving 1,000 feet or more, the depth depending on the location of the well; the farther away from the mountains it may be dug the deeper it will need to be sunk to reach the water-bearing beds. A rough approximation of the depth to the Richfield spring water may be afforded by its temperature, 74° F., which is 26° above the mean annual temperature. If the temperature be due to the internal heat of the earth, which, it is assumed, increases about

1 degree in every 50 feet, the water is derived from a depth of about 1,300 feet. It is possible, however, that the water owes its temperature in part to the proximity of heated igneous rocks.

Inverury and Annabelle, small towns situated on opposite sides of the Sevier, 4 miles south of Richfield, are supported by irrigation from canals fed by the river. Inverury is supplied with poor drinking water from shallow wells, although water of better quality can be obtained by driving deeper and casing off the upper flow. Annabelle, on the other hand, derives a good supply for domestic use from reservoirs in the mountains south of the town.

Richfield, the commercial center of Sevier Valley, has a population of about 2,000. The town is situated at the foot slope of the Pavant Range, and derives its water supply from the Sevier Valley and other canals and from the spring referred to on page 25. This spring, discharging 3.2 second-feet, besides furnishing water for local irrigation, supplies the city waterworks—the best system in the entire area considered in this report. The spring is inclosed in a brick structure, whence the water is piped to a concrete reservoir and distributed through an 8-inch main. Before the waterworks were installed the town depended largely upon wells that range in depth from 15 to 20 feet. Some of these are still used; others have been abandoned and are used as cesspools, thus introducing a source of contamination which should not be tolerated.

Glenwood is prettily located in a cove, at the base of Sevier Plateau, that is separated on the west from the main valley by a low lava-capped ridge. The town and its vicinity are supplied with water for irrigation and domestic use by springs. East and west of the lava-capped ridge there are springs whose discharge aggregates about 20 second-feet. Those on the west side of the ridge are reported to have broken out since 1880, and their flow is so copious that a considerable area has been converted into marsh land. The conditions here can be improved by drainage and by conveying the surplus water where it is more needed. The springs on the east side of the ridge discharge 9 second-feet and are the source of Cove Creek. At an elevation of 250 feet above the town Glenwood Springs issue from débris at the base of igneous hills and form the main local supply for all purposes, the discharge being 7 second-feet. Although the supply is plentiful, a needed improvement is the installation of a waterworks system that would do away with the present insanitary practice of obtaining domestic water directly from open ditches in the streets. The springs also afford an excellent source of power, which is as yet undeveloped. North of Glenwood, along the base of the mountains, there are other springs, notably Herrins Hole Springs and Black Knoll Springs, which yield respectively 1 and 12 second-feet. All of these springs probably rise along faults.

SALINA AND VICINITY.

Between Richfield and Salina the character of the country changes. On the east of the valley the Sevier Plateau, an area of igneous rocks, slopes rapidly northward to the interval separating it from the Wasatch Plateau, which is underlain by sedimentary rocks. A narrow belt of gypsiferous drab and red shales, capped here and there with lava, lies between the base of the plateaus and Sevier River. On the west side of the valley the eastward-dipping Eocene beds of the Valley Mountains are separated by a fault from the red conglomerates and sandstones of the Pavant Range. The appearance of the valley also changes. West of the river the canals water a relatively narrow strip, beyond which there is a long desert slope up to the base of the mountains, while on the east still less land is irrigated from small ditches fed by creeks.

Here, as throughout the valley, the lowlands are superficially underlain by fine-textured soils, while the foot slopes of the mountains are littered with coarse débris. Ground water lies between 10 and 50 feet from the surface in a belt contiguous to the river, where most of the wells have been sunk. They are chiefly driven wells, 2 or 3 inches in diameter and from 100 to a little over 200 feet in depth. This depth, unusual in Sevier Valley, is necessitated by the strongly saline character of the water nearer the surface, due to the proximity of the salt and gypsum-bearing shales. The wells first penetrate about 60 feet of clay, below which lie alternating layers of gravel and clay. Each gravel bed yields water under pressure that causes it to rise within a few feet of the surface. Along the entire length of Sevier Valley, between Venice and Gunnison, the character of the ground water is impaired by salts leached from the adjacent Jurassic beds. These salts, however, apparently do not permeate the valley deposits throughout their entire thickness, but seem to be confined largely to the upper layers by beds of clay, so that water of better quality is obtained by deep wells.

The character and structure of the bed rocks in the highlands immediately adjacent to the valley between Richfield and Salina are not in general favorable for storing or yielding much water, but water under pressure probably can be obtained in the red sandstone and conglomerate north of Richfield (p. 10). Artesian water may probably also be obtained in the valley of Salina Creek, several miles above Salina, a probability which, in view of the needs of the town, becomes important. As has been stated in the outline of the geology of the region (p. 9), thick sandstones that dip westward at a low angle and are overlain by Eocene beds outcrop in the upper valley of Salina Creek. Here the opportunities for absorption are good, and it is likely that wells that penetrate to saturated horizons of the sand-

stone will strike artesian water. If a test well be sunk it should be located at least 5 miles up the creek from Salina, for a fault probably lies between the small outcrop of Colorado age and the water-bearing beds.

Salina is situated at the base of the salt and gypsum bearing shales, near the mouth of Salina Creek. The town obtains its supply of water for domestic uses from ditches fed by the creek, and from dug wells, but the water from both sources is of poor quality. An effort was made in 1905 to obtain good water by sinking a 4-inch well to a depth of 163 feet, where water was encountered which rose within 12 feet of the surface. The site was not particularly good and the depth not great, so the test proved unsuccessful.

Log of Salina town well, in feet.

	Thickness.	Depth.
Clay and sandy soil	35	35
Sand and gravel	91	126
Hard white layer	24	150
Sand and gravel	13	163

A sample of water from the lower sand and gravel in this well was analyzed by H. Harms, of Salt Lake City, and found to contain 1,708 parts per million of dissolved solids, 728 of which are chlorine. This large content of salts renders the water undesirable for drinking purposes. A number of families have their drinking water hauled from Colby's well (No. 85 on map), about 4 miles southwest of Salina, which is reported to contain only 576 parts per million of dissolved salts, but this practice is only a makeshift. Further tests should be made with deep wells in the valley, away from the immediate influence of Salina Creek, and deep enough to escape seepage of water containing salts derived from the adjacent hills. It is desirable also that a test be made for artesian water up the valley of Salina Creek. The nearest good surface water is derived from feeble streams in the Pavant Mountains and from Salina Creek above the belt of saline rocks.

The small town of Aurora, 5 miles southwest of Salina, is supplied mainly by canals. A few wells, over 100 feet in depth, here obtain a fairly good supply beneath the saline surface water. The water rises in these wells within 20 or 40 feet of the surface. It is desirable that a deep test well be sunk in this part of the valley to determine whether water of good quality can be obtained under pressure sufficient to flow at the surface. It is possible that the spring 2 miles west of town can be developed so as to yield enough water for domestic uses.

Redmond is plentifully supplied with water, its chief asset being the springs that feed Redmond Lake. These issue from the bottom and edges of the lake and discharge about 13.5 second-feet. The temperature of one small spring of the group in August, 1905, was 70° F., which, together with the large amount of water the springs yield, suggests that they occur along a fault, which, however, has not been traced on the surface. Ditch water is generally used for domestic use, and little attention is given to its sanitary character. By fencing the lake and piping the supply used for drinking, water of excellent quality can be cheaply obtained. Ground water occurs within 10 feet of the surface in the lower part of the town, although there are but few wells. One well (No. 106 on the map), about a mile northeast of Redmond, was sunk to a depth of 180 feet passing through the following material:

Log of well No. 106, in feet.

	Thickness.	Depth.
Clay	20	20
Sand and clay	83	103
Clay	17	120
Gravel	22	142
Clay	38	180

Water in the lower gravel rises within 3.5 feet of the surface.

GUNNISON AND VICINITY.

A few miles north of Redmond, west of the river, there is a narrow belt of low hills, below which the valley broadens, reaching a width of 9 miles at Gunnison. The lowlands are underlain by clay, while the slopes on both sides of the valley are composed of coarser textured deposits that extend to the base of the mountains. Canals, fed either from Sevier River or San Pitch Creek, supply the lower part of the valley, which locally is so wet as to need drainage; but above the ditches desert conditions prevail.

Ground water lies within 50 feet of the surface in a considerable area in this part of the valley, and a number of wells have been sunk here. West of Gunnison, near the river, there are many flowing wells that average only 30 feet in depth. The water occurs in gravel beneath about 25 feet of clay, and the wells, which are 2 inches in diameter, flow about 50 gallons a minute under a pressure at the surface of about 1 pound.

Farther up the valley, in the vicinity of Axtel, about 1 mile east of the river, there is a group of dug wells that average 60 feet in depth. The deepest bore hole in this part of the valley is 1½ inches in diameter and 200 feet deep (No. 109 on the map). In this well alkaline water is found in sand at a depth of 45 feet, below which between

160 and 200 feet of alternating beds of sand and gravel, separated by clay, were encountered, which yielded a better quality of water that rose within 26 feet of the surface. Although the strata of the valley range dip toward the river, the catchment area is small, the rocks are chiefly fine-textured shales and limestones, and the opportunities for absorption and transmission are poor. On the east side of the valley the conditions are worse, for the little water that is contained in the gypsiferous shales is strongly impregnated with dissolved salts.

The town of Gunnison is situated at the southern end of the Gunnison Plateau, near the mouth of San Pitch Creek. A fair amount of water is furnished by canals, but there is urgent need for a supply of pure drinking water. There are a few shallow wells which derive their supply largely from the seepage of the canals. The water level in these wells fluctuates about 10 feet a year, being highest in the midst of the irrigation season. South of Gunnison a number of wells, less than 50 feet deep, have been sunk into the valley deposits, in which water is found in gravel beneath the surface cover of clay. The supply is derived largely from the seepage from the canals, and the quality of the water is only fair. No deep wells have been sunk in this part of the valley, and although the elevation is so high that flowing wells can hardly be expected, it is likely that a better quality can be obtained beneath the upper waters, and a test should be made. Probably the most satisfactory domestic supply for Gunnison is obtainable from springs at the base of the Wasatch Plateau north of Mayfield, presently to be described.

MAYFIELD AND VICINITY.

Mayfield is situated on Twelvemile Creek where it emerges from its canyon in the Wasatch Plateau, in a narrow lowland known as Arapien Valley, that trends north-south along a fault. On the west is a range of hills composed of eastward-dipping gypsiferous shales, and on the east is the dip slope of the Wasatch monocline. Mayfield and Arapien Valley are watered by ditches that tap Twelvemile Creek at the mouth of its canyon. A spring near the bed of the creek about 1 mile above town may be utilized as a source of domestic supply.

A number of wells, ranging in from 45 to 60 feet, have been sunk in the town, but many of them go dry, or almost dry, in the late winter, although during the irrigation season they contain between 15 and 20 feet of water. The westward-dipping sandstones that outcrop in the upper valley of Twelvemile Creek may contain water under pressure. The conditions here are complicated by minor step faulting along the flanks of the monocline, but it is likely that wells sunk near the mouth of the canyon deep enough to penetrate

the overlying Wasatch beds will strike artesian water in the sandstone.

In the hilly faulted zone between Mayfield and Manti the main supply of underground water is derived from springs, including both fault and seep springs, 14 of which yield more than 16 second-feet. These comprise both seep and fault springs. The most remarkable spring in this area is that in the Morrison coal mine (No. 28 on map), east of Sterling. Before the mine was opened the hillside at the entrance to the mine was dry, but in driving the tunnel through the eastward-dipping sandstone water was encountered, the amount increasing with the length of the workings, until a stream was developed which in August, 1905, discharged 5.6 second-feet. It is likely that the water is brought up through the fault east of the mine from the westward-dipping sandstone that outcrops on the Wasatch Plateau. The water being under hydrostatic pressure, rises when it reaches the fault plane, as illustrated in fig. 4, p. 26. This spring suggests the desirability of prospecting for similar occurrences.

The small town of Sterling is watered by Sixmile Creek, which furnishes a good supply for irrigation, but the insanitary custom prevails of using for domestic purposes the ditch water that flows through the streets. The conditions can also be improved by developing springs or by piping from the creek above the town.

MANTI AND EPHRAIM.

Above the narrows of San Pitch Creek the valley broadens to a width of 5 miles at Manti and becomes 8 miles wide at Ephraim. On the west Gunnison Plateau, which is underlain for the most part by Eocene strata that dip west at a low angle, rises abruptly above the valley along a fault. On the east low, detached hills, composed of westward-dipping Manti beds, lie at the base of the Wasatch monocline. Where the creeks have cut deep, small outcrops of Laramie (?) sandstone are exposed below the Eocene strata, which underlie the surface of the greater part of the monocline in this area. Water for irrigation is supplied by San Pitch, Ephraim, Willow, and Manti creeks, which are supplemented in the lowlands to a small extent by flowing wells. The central part of the valley between Manti and Ephraim is occupied by a marsh. The conditions here, however, are reported to have been improved since the early days of settlement by the diversion of the waters of San Pitch Creek for use in irrigation, and considerable areas have been reclaimed.

Ground water lies within 10 feet of the surface in a large area in the central part of the valley, where many wells have been driven, but toward the mountains water lies deeper and there are only a few dug wells. Most of the wells in the lowlands are 1¼ or 2 inches in

diameter and between 125 and 300 feet in depth. Judging by the imperfect records, there is little uniformity in the distribution of the deposits, which appear to be lenticular masses of gravel, sand, and clay. A typical section is afforded by the following log:

Log of R. Taylor well, in SW. ¼ sec. 33, T. 15 S., R. 3 E. (*No. 190 on p. 55.*)

	Thickness.	Depth.
Clay with streaks of gravel	25	25
Clay	115	140
Sand and gravel	6	146
Clay and sand	145	291
Gravel	3	294

In this well the first flow was obtained at 140 feet, and a stronger flow, amounting to 28 gallons a minute under a pressure of 5 pounds at the surface, was encountered in the lowest gravel. Most of the wells in this area do not go beyond the first flow, which is commonly reached at a depth of about 125 feet, but in some wells as many as six flows are encountered between 125 and 300 feet. The flow of all the wells in this vicinity varies more or less with the season, and the yield of the shallower ones particularly is greater in summer than in winter. It is also found that the sinking of a new well in an area where wells are close together frequently interferes with the flow of the old ones. On the eastern side of the valley, whence the main supply is derived, the wells are better and more gravel is reported. It is desirable in this region to drive a deep well to test conditions and to sink more wells of larger bore to the lower horizons to obtain increased flows. In order to ascertain conditions concerning the available supply for pumping, experimental wells should also be put down outside of the area where flows are obtained. It is probable also that deep wells sunk near the base of the mountains on the east side of the valley will strike water under pressure in the Laramie sandstone, but the absorption area here is not so large as that farther north.

Manti is built on the alluvial fan of Manti Creek, which is the chief source of water supply. The town is underlain by coarse gravel in which are few wells, the deepest having been sunk about 100 feet, and very little water is reported to have been found. Manti is one of the few towns in this area that are provided with waterworks. Seep springs in the mountains on the south side of the creek have been developed, whence the water is piped to the city, and furnish a good supply.

Ephraim, situated on the alluvial slope about 2 miles below the mouth of the canyon of Ephraim Creek, is supplied with water for domestic purposes by a number of wells, the depth of which increases with the surface elevation. The wells in the lower part of town are

only 30 feet deep, but those farther east are 90 feet. In the upper outskirts there are no wells, and the people depend on the ditches for water. A few years ago a well 2 inches in diameter and 440 feet deep was sunk near the town hall in search of flowing water. At 160 feet water was found which rose to 17 feet below the surface, and at 340 feet water stood in the pipe 60 feet below the ground. It is reported that the lower 100 feet of the drilling was through bed rock. A considerable part of the town appears to be underlain to a depth of from 10 to 20 feet by clay, which overlies water-bearing sand and gravel. The water is therefore protected to a certain extent from contamination, but a better supply is available in springs a few miles up Ephraim Canyon.

MORONI AND VICINITY.

Between Ephraim and Moroni the conditions are similar to those farther south. A number of flowing wells have been obtained in the lowlands, while the uplands remain to a large extent undeveloped. Some of the best wells in the area under consideration are located here. Most of them are 2 inches in diameter and about 130 feet deep, and discharge from 10 to 30 gallons a minute; but a well in NW. ¼ sec. 9, T. 16 S., R. 3 E., belonging to Joseph Seely, is exceptional in character. This well is 4 inches in diameter and 344 feet deep and yields 160 gallons a minute under a pressure of 6 pounds at the surface. An approximate record of this well is as follows:

Approximate record of well No. 205, in feet.

	Depth.	Thickness.
Clay	15	15
Sand with streaks of clay	80	65
Clay	130	50
Sand	150	20
Alternating layers of gravel, sand, and clay	344	194

Several flows were obtained between 130 and 344 feet, but the best one occurred at the latter depth, in a bed of gravel 10 feet thick. In one well the drill was sunk 300 feet deeper, through clay all the way. These results will probably encourage the sinking of other wells in this vicinity. The extent of the area in which these conditions prevail can be determined only by testing, but it may be conjectured that they persist at least over several square miles.

The town of Moroni is situated at the southern end of the highland between the two forks of Sanpete Valley. Canals fed by San Pitch Creek form its chief source of water supply, but the town is poorly provided with water for domestic purposes. There are a number of dug wells, ranging in depth from 10 to 60 feet. The qual-

ity of the water, however, is impaired by seepage from the upper canal. Probably the springs on the west side of the valley (p. 103) are the most desirable source of water for the domestic supply of Moroni.

FOUNTAIN GREEN AND WALES.

The broad western fork of Sanpete Valley is bordered on the east by a low, barren ridge, underlain by Eocene shales and limestones and capped by lava flows, and is limited on the west by the high and narrow Gunnison Plateau. The northern end of the plateau is underlain by beds of sandstone and conglomerate, which lie almost flat or dip westward at a low angle, while farther south these beds are capped by shales and limestones, and along the eastern border steep-lying, eastward-dipping beds of sandstone and conglomerate mark the presence of a fault. Toward the northwest the valley narrows, and about 4 miles above Fountain Green terminates at the débris-covered divide between Sanpete and Salt Creek valleys. No perennial streams are fed by the run-off in this area, but a remarkable series of springs issue along the base of Gunnison Plateau.

Between Moroni and Fountain Green, ground water lies within 10 feet of the surface in a narrow belt, above which it lies at greater depths, as shown on the map (Pl. VI). In this region there are a few flowing wells and a number of pumping ones, but the main water supply is derived from springs.

Within a distance of 10 miles between Wales and Fountain Green, associated with the fault at the base of Gunnison Plateau, there are seven springs, the aggregate yield of which amounts to 15.9 second-feet. These springs have many features in common. Their temperature is about the same, approximating the mean annual temperature of the region; the water of all contains abundant calcium carbonate, which is deposited as tufa; and the flow, except that of one spring, is reported not to vary. The discharge of these springs is not affected by heavy showers, and in view of the small tributary drainage area and the scarcity of limestone, a distant though unknown source is indicated. Possibly the water is derived from the westward-dipping sandstone that outcrops on the Wasatch Plateau and probably underlies the valley. This chance suggests the desirability of sinking a deep well in the valley in search of artesian water from bed rock (pp. 22–23). The dip of the sandstone may flatten out, for the low temperature of the springs does not imply a deep-seated source, but the depth to the water-bearing beds can not be predicted.

It is reported that the flow of one of these springs (No. 70 on map) was increased fivefold by driving a tunnel through débris to bed rock. This, together with the general facts of occurrence, suggest that prospecting might profitably be undertaken along the fault line with

the idea of increasing present supplies and of developing new ones.

Another point should be mentioned. The springs are separated from the settlements by a mile or more of sand and gravel, in which loss occurs by absorption, although aeration of the water causes the precipitation of calcium carbonate, which tends to seal the channels, especially in their upper part. Much of this loss could be prevented by using pipes instead of ditches.

Wales is situated on the alluvial slope near the base of the plateau and is supplied with water principally from Wales Creek and from springs northwest of the town. There are a few wells in Wales, ranging from 30 to 90 feet in depth, and the fields below the town are irrigated from a reservoir below Moroni. The quality of the domestic supply can be much improved by using pipes instead of open ditches to convey water from the springs.

The small town of Freedom is noteworthy as being one of the few settlements in the area under consideration that have public water systems. The flow of Current Spring, amounting to about 1 second-foot, is distributed through pipes and furnishes a very satisfactory supply.

Fountain Green is suppled almost entirely by the large spring at the base of the plateau about a mile and a half west of the town. (Pl. IV, A.) The yield of this spring, as measured by C. S. Jarvis in September, 1905, amounted to 12.4 second-feet. It is reported that the winter discharge falls off perceptibly, but figures to verify this report are not available. The domestic supply would be bettered in quality if the water were distributed in pipes instead of open ditches.

There are a number of dug wells in and about Fountain Green, ranging from 10 to 50 feet in depth; and about 1896 the town sank a 2-inch well to a depth of 285 feet, the log of which is given below:

Log of well at Fountain Green, No. 218.

	Thickness.	Depth.
Gravel	15	15
Alternate beds of clay, sand, and gravel	98	113
Clay	87	200
Sand	60	260
Clay	25	285

MOUNT PLEASANT AND VICINITY.

The eastern fork of Sanpete Valley is occupied by the headwaters of San Pitch Creek. On the west the low hills that separate the two forks are underlain by Eocene shales and limestones that dip westward at a low angle and are locally capped by lava, and on the east the Wasatch Plateau towers above the valley. In this part of the

plateau the summits and most of the western flank are formed of Laramie (?) sandstone, and Eocene strata outcrop on the lower slopes. Here, as farther south, the monocline is well developed, and the rocks that cap the plateau dip beneath the valley filling. Spring City, Mount Pleasant, Fairview, and Milburn are situated on the east side of the valley, and their water supply is derived from the main creek and its branches, supplemented by a number of wells and springs.

The central part of the valley is occupied by a narrow belt in which ground water lies within 10 feet of the surface. Above the lowlands the surface rises to the base of the mountains at a rate of slightly over 100 feet a mile. The upper portion of this slope, above the canals, is a sagebrush-covered desert, beneath which ground water lies at a considerable but unknown depth.

The wells in the lowland are chiefly shallow dug ones, possessing no unusual features, and the main supply of underground water is derived from springs. These are situated in low meadows adjacent to creeks and are all seep springs, of which there are several groups in this portion of the valley. An important group includes those belonging to the sugar company, located about 3 miles east of Moroni, adjacent to Cedar Creek, which in all discharge 3.8 second-feet. Another group, about 2 miles northeast of these, flows 2½ second-feet. Above Mount Pleasant, adjacent to San Pitch Creek, there are numerous seeps, and in the vicinity of Fairview the total discharge of springs, determined by gaging the creek above and below the town in September, 1905, amounted to 12 second-feet.

The Madsen and Seely tunnel, about half a mile west of the railroad station at Mount Pleasant, affords an instructive example of the successful development of a spring. There the flow of a small seep has been increased several fold by tunneling, and the experiment might be repeated elesewhere to advantage. (See p. 28.)

The extensive outcrop of sandstone on the crest and flanks of the Wasatch Plateau east of upper Sanpete Valley affords an excellent opportunity for absorption, and the westward dip and capping of Wasatch beds at the base of the plateau are favorable for obtaining water under pressure in wells sunk into the sandstone. These conditions are well developed between Spring City and Milburn. If results are favorable, it is likely that flows can be obtained well up on the barren slopes toward the base of the mountains.

Spring City is situated near the base of a long alluvial slope in an embayment that is partly separated from the main valley by a low ridge of westward-dipping Manti beds. The main water supply is obtained from ditches fed by Canal and Oak creeks, supplemented

by springs and wells. Ground water lies within 10 feet of the surface in a narrow stip adjoining the lower part of the town, but in the upper part the depth to water increases to 50 feet or more. There are a few flowing wells in the valley deposits southwest of Spring City. Wells Nos. 194 and 195 are 2 inches in diameter, 200 feet deep, and yield an average flow of 20 gallons a minute under a pressure of 3½ pounds at the surface. A feeble first flow was obtained at 150 feet and the main flow at 200 feet. Similar results can doubtless be obtained in other wells. There are a number of seep springs in and near the town, the discharge of which ranges between 4 and 44 gallons a minute. It is likely that the yield can be increased and other springs developed by tunneling.

Mount Pleasant, located on the alluvial slope about midway between San Pitch and the base of the mountains, has lately installed public waterworks. Water is diverted from Pleasant Creek near the mouth of its canyon and flumed to a reservoir, whence it is distributed throughout the town. The success of this project shows what can be accomplished at small cost by most of the settlements in Sanpete and Sevier valleys. The depth to ground water ranges from 10 feet in the lower part to more than 100 feet in the upper part of the town. Approximate measurements show that the slope of the ground-water surface is less than that of the ground, the figures being respectively 95 and 170 feet in a mile. The annual fluctuation of the ground-water surface between summer maximum and winter minimum is reported to average about 10 feet.

Fairview and Milburn are situated near San Pitch Creek, at the base of the alluvial slope. In the lower part of the towns ground water lies near the surface, and swampy places exist, while on the upper slopes depth to water is considerably over 50 feet. Springs can be developed in this vicinity, and it is desirable that a deep test well should be sunk in the lower part of the valley.

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Data concerning wells in Sanpete and Sevier valleys, Utah.

No.	Name.	Year sunk.	Location.			Diameter.[a]	Depth.	Height of water.[b]	Depth to main water bed.	Nature of main water bed.	Use.[c]	Yield.
			Township.	Range.	Section.							
						Inches.	*Feet.*	*Feet.*	*Feet.*			
1	J. H. Levi	1905	25 S.	4 W.	NE. ¼, 32		40	−32	38	Clay and gravel	D. S.	[d]150
2	W. F. Bridges	1905	25 S.	4 W.	SW. ¼, 28		47	−37	42	Sand	D.	[d]100
4	A. Sorenson	1890	25 S.	3 W.	NW. ¼, 21		112	−90	96	Gravel	D. S.	[e]8
5	F. M. Ross	1902	25 S.	4 W.	NE. ¼, 22		72	−63	70	....do	D.	[d]50
6	A. McMeekin	1900	25 S.	3 W.	NW. ¼, 15		98	−86	94	....do	D.	
7	E. S. Skinner	1897	25 S.	4 W.	SE. ¼, 15		54.5	−43	52	....do	D. S.	[d]200
8	O. Bowen	1900	25 S.	4 W.	SW. ¼, 14		35	−25	33	....do	D.	[d]75
9	A. Gay	1890	25 S.	4 W.	NE. ¼, 14		27	−16	25	....do	D.	[d]100
10	J. A. Ross	1892	25 S.	4 W.	NE. ¼, 15		56	−44	54	....do	D. S.	[d]200
11	G. L. Ross	1895	25 S.	4 W.	NW. ¼, 14		47	−36	46	....do	D. S.	[d]400
12	G. W. Ross	1894	25 S.	4 W.	NW. ¼, 14		45	−35	42	....do	D.	[d]200
13	H. Tuft	1899	25 S.	3 W.	SW. ¼, 10		90	−65	77	....do	D. S.	[d]300
14	A. Anderson	1896	25 S.	3 W.	SW. ¼, 10		64	−56	58	....do	D. S.	[d]300
15	D. M. Crawford	1897	25 S.	3 W.	SE. ¼, 8		81	−71	70	....do	D. S. I.	[e]10
16	A. N. Warenshi	1881	25 S.	4 W.	SW. ¼, 11		18	− 7		....do	D.	[d]50
17	J. Ross	1898	25 S.	4 W.	SW. ¼, 11		47	−38	44	....do	D.	[d]75
18	U. Graham	1896	25 S.	4 W.	NW. ¼, 11		46	−38	44	....do	D. S.	[d]200
19	C. Winget	1895	25 S.	3 W.	NW. ¼, 3		23±	−13±	14	Gravel and sand	D.	[d]100
20	J. Bland	1900	25 S.	3 W.	SE. ¼, 5		52	−43	50	Gravel	D. S.	[d]300
21	D. Barney	1898	25 S.	3 W.	SE. ¼, 5		50	−43	45	....do	D. S.	[d]400
22	L. Lisenbee	1903	25 S.	3 W.	NE. ¼, 5		46	−35±	43	....do	D. S.	[e]5
23	Brooklyn Co	1903	25 S.	3 W.	SW. ¼, 6	1¼	53	− 3	21, 30, 53	Sand and gravel	I.	[e]8
24	....do	1905	25 S.	3 W.	SW. ¼, 6	1¼	23	− 1.8	23	....do	I.	[e]31
25	....do	1905	25 S.	3 W.	SW. ¼, 6	1¼	21	− .75	21	....do	I.	[e]29
26	N. M. Higgins	1901	25 S.	3 W.	NW. ¼, 6		102	−90±	98	Quicksand	D. S. I.	[e]5
27	M. W. Prisbrey	1895	25 S.	4 W.	SW. ¼, 1		33	−28	31	Gravel		
28	T. Roberts	1893	25 S.	4 W.	SE. ¼, 2		41	−35	39±	....do	D.	[d]50
29	J. Willes	1900	25 S.	4 W.	SW. ¼, 2		46	−40	44	....do	D. S.	[d]200
30	P. P. Washburn	1889	24 S.	3 W.	NW. ¼, 35		31	−27	26	....do	D. S.	[d]125
31	L. Anderson	1885	24 S.	3 W.	NW. ¼, 35		39	−29	32	....do	D. S.	[d]200
32	G. Hicks	1893	24 S.	3 W.	SW. ¼, 34		19	−11	13	....do	D. S.	[d]300
33	N. Foreman	1887	24 S.	3 W.	NW. ¼, 34		20	−15	20	....do	D. S.	[d]200
34	J. H. Lowe	1889	24 S.	3 W.	NE. ¼, 33		25	−16	23	....do	D. S.	[e]8
35	O. P. Lee	1896	24 S.	3 W.	NW. ¼, 33		37	−20	29	....do	D. S. I.	[e]5

[a] If bored. Wells whose diameter is not given or queried (?) are dug.
[b] Height of water below surface indicated by minus mark (−); height to which water rises above surface indicated by plus mark (+).
[c] D. = Domestic; S. = Stock; I. = Irrigation.
[d] Gallons per day.
[e] Gallons per minute.

Data concerning wells in Sanpete and Sevier valleys, Utah—Continued.

No.	Name.	Year sunk.	Location. Township.	Range.	Section.	Diameter.	Depth.	Height of water.	Depth to main water bed.	Nature of main water bed.	Use.	Yield.
						Inches.	*Feet.*	*Feet.*	*Feet.*			
36	J. A. Moore	1897	24 S.	3 W.	NW. ¼, 33		35	− 24	33	Gravel	D. S.	*a* 200
37	L. W. Munson	1893	24 S.	3 W.	NE. ¼, 32		50	− 30	35	Sand	D. S.	*b* 6
38	C. L. Hutchings	1887	24 S.	3 W.	E. ½, 32		40	− 30	28	Gravel	D. S.	*a* 400
39	J. F. Shaw	1892	24 S.	3 W.	NE. ¼, 32		40	− 31	38	....do	D. S.	*b* 5
40	C. O. Keeler	1898	24 S.	3 W.	SW. ¼, 32		48±	− 35+	36	....do	D. S.	*b* 5
41	J. W. Nunley	1904	24 S.	3 W.	NE. ¼, 32		35	− 24	33	....do	D. S.	*b* 5
42	S. C. Petersen	1892	24 S.	3 W.	SE. ¼, 29		50±	− 36	45	....do	D. S.	*b* 8
43	J. P. Hansen	1902	24 S.	3 W.	SE. ¼, 29		56	− 53	53	....do	D.	*b* 6
44	S. Sorenson	1890	24 S.	3 W.	SE. ¼, 29		60	− 53	56	....do	D.	*b* 5
45	J. B. Sylvester	1903	24 S.	3 W.	NE. ¼, 29		60	− 59	62		D.	*b* 4
46	R. M. Nieken	1903	24 S.	3 W.	NE. ¼, 29		115	−110±	109	Sand	D.	*b* 4
47	H. Christophersen	1903	24 S.	3 W.	NE. ¼, 29		98	− 56	93	Gravel and sand	D.	*b* 4
48	W. F. Porter	1898	24 S.	3 W.	SE. ¼, 23	1¼	40	− 18±	18	Clay and gravel	D. S.	*a* 500
49	E. B. Stewart	1896	24 S.	3 W.	NW. ¼, 23		27	− 21	24+	....do	D. S.	*a* 300
50	J. Nordfors	1903	24 S.	2 W.	SW. ¼, 18		60	− 58	58	Gravel	D. S.	*a* 200
51	G. W. Williams	1897	24 S.	2 W.	SE. ¼, 18		62	− 59	59	....do	D. S. I.	*b* 6
52	E. B. Keyes	1899	24 S.	2 W.	SW. ¼, 18		33	− 30	30	....do	D.	*a* 100
53	F. L. Hansen	1902	24 S.	3 W.	NE. ¼, 12	1¼	49	+ 3.7	49±	....do	S. I.	*b* 15¼
54	W. F. Wright	1900	24 S.	2 W.	NE. ¼, 7	2	63	+ 0.5	60	Sand and gravel	D. S. I.	*b* 15±
55	J. M. Petersen	1895	24 S.	2 W.	NW. ¼, 6	1¼	60+	+ 3.7	50±	Gravel	I.	*b* 18
56	....do	1900	24 S.	2 W.	NW. ¼, 6	3	57	.....	50+	....do	I.	*b* 95
57	....do	1900	24 S.	2 W.	NW. ¼, 6	6	63+	+ 2.9	50±	....do	I.	*b* 142
58	G. Petersen	1900	23 S.	3 W.	NW. ¼, 36		13	− 4	7	Clay	D.	*a* 75
59	J. Wilkinson	1902	23 S.	2 W.	NE. ¼, 31	4	62	+ 3.6	40, 60	Gravel	S. I.	*b* 132
60	J. Borgquist	1901	23 S.	2 W.	NE. ¼, 31	4	70	+ 2.5	50	Sand and gravel	I.	*b* 110±
61	....do	1890	23 S.	2 W.	SE. ¼, 31	¾	70	+ 2.4	50	....do	I.	*b* 3½
62	....do	1901	23 S.	2 W.	NE. ¼, 31	4	70	+ 2.5	50	....do	I.	*b* 110±
63	W. H. Seegmiller	1901	23 S.	2 W.	NE. ¼, 32	3	72	+ 2.9	71	Gravel	I.	*b* 42
64	....do	1901	23 S.	2 W.	NE. ¼, 32	3	69	+ 2.9	68	....do	I.	*b* 62
65	J. Sorenson	1890	23 S.	2 W.	SE. ¼, 26		13	− 11	12.5	Sand	D. S.	*a* 100
66	P. Johnson	1890	23 S.	2 W.	SE. ¼, 26		20.5	− 18	18	....do	D. S.	*a* 350
67	J. M. Bolitho	1901	23 S.	2 W.	SW. ¼, 29	2	82.5	+ 3.1	56+	Sand and gravel	S. I.	*b* 27
68	....do	1901	23 S.	2 W.	SW. ¼, 29	3	95	+ 3	56+	....do	S. I.	*b* 62
69	....do	1901	23 S.	2 W.	NW. ¼, 29	4	88	+ 2.2		....do	D. S. I.	*b* 125
70	H. P. Petersen	1887	23 S.	3 W.	SE. ¼, 25		17	− 10	14	Gravel	D. S.	*a* 50
71	H. Nellsen	1898	23 S.	3 W.	NE. ¼, 26		80	− 76	77	....do	D.	*a* 50
72	P. Jensen	1903	23 S.	3 W.	NE. ¼, 26	4	208	−110+	110 200			
73	J. M. Lauritzen	1905	23 S.	3 W.	SE. ¼, 23		51	50	50			
74	J. M. Kirkman	1902	23 S.	2 W.	SE. ¼, 15	2	75	+ 2.3	75	Gravel	D. S. I.	*b* 25
75	J. C. Cowley	1900	23 S.	2 W.	SE. ¼, 15	2	80	+ 1.1	60 70	Sand and gravel	D. S. I.	*b* 10+

77	G. Pectol	1898	23 S.	2 W.	NE. ¼, 1	2	38	− 11±	36±	Gravel and sand	D. S.		[a] 100
78	O. Dastrup	1896	23 S.	2 W.	NE. ¼, 1	1½	62	− 11	40 60	Sand	D.		[a] 100
79	C. Myers	1899	22 S.	2 W.	SE. ¼, 36	2	102	− 16	18+		D. S.		[a] 300
80	O. Dastrup	1901	22 S.	2 W.	SE. ¼, 36	1½	51	+ 3.75	50±	Gravel and sand	D. S.		[b] 8±
81	F. Glenhill	1902	22 S.	2 W.	NE. ¼, 25	2	109	− 29	30 105	Sand and gravel	D. S. I.		[a] 350
82	J. Tholman	1898	22 S.	2 W.	NE. ¼, 25		41	− 40	40	Gravel	D. S.		[a] 150
83	A. Shaw	1903	22 S.	1 W.	NW. ¼, 19		57	− 51.5	54±	do	S		[a] 100
84	M. Kane	1905	22 S.	1 W.	NE. ¼, 19	2	73	− 30±	25 50 70	Sand	D. S.		[a] 100
85	J. Colby	1901	22 S.	1 W.	SE. ¼, 4	2	120	− 15	15 110	Sand and gravel	D. S.		[a] 600
86	D. E. Stevens	1898	22 S.	1 W.	SW. ¼, 4	2	100	− 7	100	do	D. S.		[a] 300
87	J. H. Kennedy	1902	22 S.	1 W.	NE. ¼, 4	2	95	− 3	90	Gravel and sand	D. S.		[a] 350
88	G. Holdaway	1900	22 S.	1 W.	NW. ¼, 4	2	212	− 6	212	Gravel	D. S.		[a] 750
89	E. Sorenson	1905	22 S.	1 W.	SE. ¼, 5	3	215	− 32	20	do	D. S.		[a] 225
90	J. Curtis	1905	22 S.	1 W.	SW. ¼, 5	2	176	− 47	60+	do	D. S.		[a] 200
91	S. Harding	1898	21 S.	1 W.	SE. ¼, 34	2	125	− 8±	125		D. S.		[a] 200
92	J. Neilson	1900	21 S.	1 W.	NE. ¼, 26		17	− 13	15	Gravel	D. S.		[a] 200
93	H. C. Neilson	1893	21 S.	1 W.	NE. ¼, 26		27	− 23	25±	do	D. S.		[a] 200
94	J. W. Phillips	1888	21 S.	1 W.	NW. ¼, 25		35	− 30	35	do	D. S.		[a] 250
95	Townwell Salina	1905	21 S.	1 W.	NW. ¼, 25	4	163	− 42	37 150	do			[b] 30
96	J. S. Jensen	1889	21 S.	1 W.	NW. ¼, 25		43	− 35	43	do	D. S. I.		[a] 2,500
97	White House well	1899	21 S.	1 W.	NE. ¼, 25		46	− 40	43	do	D. S.		[a] 200
98	E. W. Crane	1889	21 S.	1 W.	NE. ¼ 25		52	− 41	42	do	D. S.		[a] 300
99	G. S. Williams	1901	21 S.	1 W.	NE. ¼, 25		65	− 61	65	do			
100	J. Anderson	1892	21 S.	1 W.	NE. ¼, 24		23	− 17	23	do	D. S.		[a] 200
101	H. C. Neilson	1888	21 S.	1 W.	NW. ¼, 22		46	− 40	44	Clay	D. S.		[a] 300
101a	A. J. Scott	1905	21 S.	1 W.	NE. ¼, 19	2	530	− 8	69	Gravel			
102	D. Allred	1890	21 S.	1 W.	SE. ¼, 13		10.5	− 9.5	9.5±	do	D. S.		[a] 100
103	W. B. Humphrey	1901	21 S.	1 W.	SW. ¼, 15		60	− 55	60	Clay	D. S.		[a] 300
104	L. M. Breinholt	1890	21 S.	1 W.	NE. ¼, 11		19.5	− 16	18±	Gravel	D. S.		[a] 450
105	P. A. Petersen	1902	21 S.	1 W.	SW. ¼, 1	2	39	− 4	39	do	D. S.		[a] 150
106	F. A. Peterson	1903	21 S.	1 W.	NE. ¼, 1	2	180	− 3.5	142	do	D. S.		[a] 200
107	J. C. Hansen	1898	20 S.	1 E.	NW. ¼, 29		64	− 63	63	Sand	D.		[a] 75
108	J. Jensen	1894	20 S.	1 E.	SW. ¼, 20		56	− 53	54	Gravel	D. S.		[a] 200
109	S. Anderson	1889	20 S.	1 E.	SE. ¼, 19	1½	200	− 26	200	Sand and gravel	D.		[a] 140
110	J. Peterson	1880	20 S.	1 E.	SE. ¼, 19		54	− 46	50	Sand	D. S.		[b] 11
111	F. T. Tilton	1898	20 S.	1 E.	SW. ¼, 16		70	− 40	64	Gravel	S.		[a] 200
112	S. Caldwell	1895	20 S.	1 E.	NW. ¼ 9		55	− 53	55	do	S.		[a] 200
113	A. J. Robbins		20 S.	1 W.	C. ¼, 12	(?)	100		60				
114	O. B. Burgland	1895	20 S.	1 E.	SE ¼, 5		42	− 31	31+	Gravel	D. S.		[a] 450
115	N. Larsen	1884	19 S.	1 E.	NE. ¼ 32		46	− 25	20	do	D. S. I.		[a] 500
116	S. Whiting	1885	19 S.	1 E.	NW. ¼ 33		54	− 33	52	do	D. S.		[a] 100
117	F. K. Christianson	1891	19 S.	2 E.	SE. ¼, 32		58	− 36	36	do	D. S.		[a] 200
118	P. Christianson	1900	19 S.	2 E.	NE. ¼, 32		60	− 35	35	do	D. S.		[a] 250
119	C. C. Larsen	1899	19 S.	2 E.	NW. ¼, 32		51	− 35	35+	do	D. S.		[a] 350

[a] Gallons per day.

[b] Gallons per minute.

Data concerning wells in Sanpete and Sevier valleys, Utah—Continued.

No.	Name.	Year sunk.	Location.			Diameter.	Depth.	Height of water.	Depth to main water bed.	Nature of main water bed.	Use.	Yield.
			Township.	Range.	Section.							
						Inches.	*Feet.*	*Feet.*	*Feet.*			
120	J. Olsen	1897	19 S..	2 E....	SE. ¼ 29....		45	−34	34+	Gravel	D. S.	a 125
121	J. Neilson	1901	19 S..	1 E....	NE. ¼ 28....		36	−21	20	....do	D. S.	a 100
122	A. Jensen	1884	19 S..	1 E....	SW. ¼ 28....		48	−25	25	....do	D. S.	a 100
123	C. Sorenson	1890	19 S..	1 E....	SE. ¼ 29....		40	−20	18	....do	D. S.	a 75
124	D. W. Woolrey	1890	19 S..	1 E....	NW. ¼ 29....		28	−14	14	....do	D. S.	a 100
125	A. J. Robbins	1890	19 S..	1 E....	NW. ¼ 30....	2	18	−3	3	....do	D	a 75
126	....do	1904	19 S..	1 E....	NW. ¼ 30....	3	186	−2	15	....do		
127	A. H. Lund	1897	19 S..	1 W....	NE. ¼ 22....		40	−38	39	....do	D. S.	a 100
128	F. L. Copering	1902	19 S..	1 W....	NW. ¼ 23....	2	80	−12±	20±	....do	D. S.	
129	L. H. Erickson	1895	19 S..	1 W....	NE. ¼ 23....		13.5	−11	11±	Clay	D	
130	....do	1902 1903 1904	19 S..	1 W....	SW. ¼ 24....	2	30	+2.9	23±	Gravel	D. S. I.	b 55
131	....do	1904	19 S..	1 W....	SW. ¼ 24....	2	30	+2.6	23±	....do	D. S. I.	b 51
132	....do	1904	19 S..	1 W....	SW. ¼ 24....	2	20	+2.9	23±	....do	D. S. I.	b 58
133	....do	1904	19 S..	1 W....	SW. ¼ 24....	2	30	+3.7	23±	....do	D. S. I.	b 32
134	....do	1904	19 S..	1 W....	SW. ¼ 24....	2	30	+3.7	23±	....do	D. S. I.	b 59
135	A. Kearns	1885	19 S..	1 E....	NE. ¼ 20....		43	−18	20	....do	D. S. I.	a 100
136	J. W. Edwards	1883	19 S..	1 E....	NE. ¼ 20....		42	−19	19	....do	D. S.	a 75
137	C. W. Perkins	1890	19 S..	1 E....	SW. ¼ 17....		20	−12	12	....do	D. S.	a 125
138	T. E. Christensen		19 S..	1 E....	SE. ¼ 17....		20	−12	20	Sandstone	D. S.	a 200
139	H. M. Childs	1890	19 S..	1 E....	SW. ¼ 16....		20	−9	9	....do	D	a 75
140	T. E. Christensen	1880	19 S..	1 E....	NW. ¼ 13....		22	−18	17	Gravel		
141	F. Swalberg	1885	19 S..	1 E....	NW. ¼ 13....		23	−15	15	....do	D	a 75
142	R. Edwards	1889	19 S..	2 E....	NE. ¼ 4....		40	−30	30	....do	S	a 75
143	H. A. Larsen	1890	18 S..	2 E....	NW. ¼ 14....	1¼	118+	+98	80	....do	S. I	b 3¼
144	E. Fox	1899	18 S..	2 E....	SE. ¼ 2....	(?)	209					
145	A. Barton	1889	18 S..	2 E....	SE. ¼ 3....	2	180±	+8	170	Gravel	S. I	b 39
146	....do	1889	18 S..	2 E....	SE. ¼ 3....	2	180±	+7	170	....do	S. I	b 15±
147	F. Tuttle	1883	17 S..	2 E....	SE. ¼ 34....	1¼	110±	+9	107±	....do	S. I	b 18
148	Robins & Erickson	1904	17 S..	2 E....	NE. ¼ 34....	2	110 210	+22	110 210	Sand and gravel	I	(c)
149	F. Tuttle	1890	17 S..	2 E....	C. ¼ 35....	1¼	135±	+5.6	133±	Gravel	S. I	b 3
150	W. Tuttle	1890	17 S..	2 E....	NE. ¼ 35....	1¼	75	+5.8	70	....do	S	b 6±
151	G. B. Cox	1894	17 S..	2 E....	NE. ¼ 35....	1¼	60	+6.7	55±	....do	S	b 6
152	F. Keller	1894	+17 S..	2 E....	NW. ¼ 25....	1¼	80+	+6	77	Sand	S. I	b 2
153	H. Maylett	1892	17 S..	2 E....	SE. ¼ 22....	1¼	130+	+11	130	Gravel	S	b 1−
154	....do	1892	17 S..	2 E....	NE. ¼ 22....	1¼	130+	+3.5		....do	S	b 3
155	E. S. Madsen	1897	17 S..	2 E....	SE. ¼ 15....	1¼		+4	125	....do	I	b 9±
156	....do	1898	17 S..	2 E....	SE. ¼ 15....	1¼		+7	125	....do	D. S. I	b 6
157	P. Peterson	1900	17 S..	3 E....	NE. ¼ 18....	1¼	115	+3.2	115	....do	D. I	b 9
158	T. S. Lund	1888	17 S..	3 E....	SE. ¼ 17....		101	80+	83	....do	D. S	a 100

159	P. Greaves	1885	17 S.	3 E.	NE. ¼, 7	1½	125	+ 7	125	Gravel and sand	S. I		b 1½
160	.....do	1890	17 S.	3 E.	NE. ¼, 7	1½	125±	+ 8.5	125	Gravel	S. I		b 11
161	.....do	1895	17 S.	3 E.	NE. ¼, 8	1½	130±	+ 6.9	80 130	.....do	S. I		b 11
162	G. L. Nellsen	1892	17 S.	3 E.	SW. ¼, 9		66	−53	50	.....do	D. S		a 175
163	H. J. Lindhardt	1895	17 S.	3 E.	NE. ¼, 9		80	−69	79.5	.....do	D. S		a 225
164	J. Stevenson	1899	17 S.	3 E.	NW. ¼, 9		42	−40	40	.....do	D. S		a 75
165	P. Graves	1860	17 S.	3 E.	NE. ¼, 9		64±	−40	38 to 50	.....do	D		a 100
166	H. G. Hansen	1898	17 S.	3 E.	NW. ¼, 9		23	−18	15	.....do	D. S		a 100
167	M. Dorins	1898	17 S.	3 E.	SE. ¼, 4		82	−76	70 to 82	Gravel and sand	D. S		a 75
168	Ephraim town well	1901	17 S.	3 E.	SE. ¼, 4	2	340	−60	340	Gravel	D		a 200
169	A. C. Olsen	1902	17 S.	3 E.	SE. ¼, 4		53	−47	45	.....do	D		a 75
170	O. Thursby	1880	17 S.	3 E.	SE. ¼, 4		33	−26	28	.....do	D. S		a 100
171	B. Carlson	1858	17 S.	3 E.	SW. ¼, 4		40	−34±	35±	.....do	D		a 75
172	C. Briggs	1895	17 S.	3 E.	NW. ¼, 6	1½	150	+ 6	3, 80, 150	Sand	S. I		17½
173	P. Jensen	1903	17 S.	3 E.	SW. ¼, 6	2	212	+24.5	212	Gravel	S. I		b 55
174	.....do	1903	17 S.	3 E.	SW. ¼, 6	2	156	+ 5	85, 132	.....do	S. I		b 19
175	J. Larsen	1903	17 S.	2 E.	NW. ¼, 1	2	294	+11.5	140	.....do	S. I		b 28
176	C. Christensen	1900	17 S.	2 E.	NE. ¼, 1	1½	150	+ 4	147	.....do	S. I		b 15
177	J. Larsen	1900	17 S.	2 E.	NW. ¼, 1	1½	152±	+ 2.5	140	.....do	D. S		a ½ − b 1½
178	P. Kesko	1904	16 S.	3 E.	NW. ¼, 28	2	130	+ 2	130	.....do			
179	.....do	1904	16 S.	3 E.	NW. ¼, 28	2	45	+ 8.6	45	.....do			b 72
180	.....do	1904	16 S.	3 E.	NW. ¼, 28	1½	135	+ 7	135	.....do			b 11
181	.....do	1904	16 S.	3 E.	NW. ¼, 28	2	130	+ 4	130	.....do	S. I		b 30
182	P. C. Petersen	1905	16 S.	3 E.	NE. ¼, 27	(?)	79	−76	78±	.....do			
183	W. Larsen	1895	16 S.	4 E.	NW. ¼, 18		51	−49	50±	.....do	D. S		a 200
184	P. Kesko	1887	16 S.	3 E.	NE. ¼, 17	1½	170±	+ 4.3	1. 70±	.....do	D. S		a 200
185	J. Seely	1901	16 S.	3 E.	NW. ¼, 9	4	344	+13.7	344	.....do	D. S. I		b 157
186	.....do	1901	16 S.	3 E.	NW. ¼, 9	3	650	+12.5	344	.....do	S. I		b 51
187	J. A. Nyberg	1902	16 S.	3 E.	SE. ¼, 5	2½	125	+ 7.5	125	.....do	D. S. I		b 36
188	H. C. Jensen	1898	16 S.	3 E.	NW. ¼, 1		27	−14	27	Sand	S		a 100
189	C. Crawford	1875	16 S.	4 E.	SE. ¼, 6		39	−35	37±	Gravel	D. S		a 150
190	R. Taylor	1889	15 S.	3 E.	SW. ¼, 33	1½	125±	+ 2.75	125	.....do	D. S		b ½
191	J. Beck	1890	15 S.	3 E.	NW. ¼, 33	1½	128	+ 2.1	128	.....do	S		b 1
192	C. R. Allred	1902	15 S.	3 E.	NW. ¼, 35	4	170	+ 4.5	170		S. I		b 16
193	P. D. Allred	1903	15 S.	3 E.	NW. ¼, 35	2	23±	−12	10	Gravel and sand	D. S. I		b 15
194	S. T. Beck	1893	15 S.	4 E.	SE. ¼, 31	2	200±	+ 7	150		D. S. I		b 16
195	.....do	1893	15 S.	4 E.	SE. ¼, 31	2	200±	+ 9	150	Gravel and sand	D. S. I		b 24
196	D. Jensen	1898	15 S.	4 E.	SE. ¼, 29		73	−68	72±	Gravel	D. S		a 75
197	C. Christensen	1899	15 S.	4 E.	SE. ¼, 29		62	−57	60±		D. S		a 150
198	D. H. Sorenson	1887	15 S.	4 E.	SE. ¼, 29		14	−11	12±	Gravel	D. S		a 125
199	F. E. Allred	1865	15 S.	4 E.	SE. ¼, 29		17	−12	15±				
200	D. Zabriskie	1902	15 S.	4 E.	SE. ¼, 29		28	−24	27±	Gravel	D		a 75
201	A. C. Strate	1900	15 S.	4 E.	SE. ¼, 30		31	−27	29	.....do	D		a 75
202	M. L. Irving	1899	15 S.	3 E.	NW. ¼, 25		12	−11	11	Clay	D		a 75
203	Gunnison Bros.' well	1905	15 S.	3 E.	SW. ¼, 26		25	−12	12	Sand	I		
204	Chester School	1894	15 S.	3 E.	SE. ¼, 27	2	40	−10±	40	Gravel and sand	D		
205	B. Conrad	1887	15 S.	3 E.	SE. ¼, 2 8	1½	70	− 3	45	Gravel	S		a 100
206	E. Christensen	1898	15 S.	3 E.	NW. ¼, 30		34	−31	32±	Clay	D. S		
207	A. R. Lamb	1895	15 S.	3 E.	NW. ¼, 30		66	−64.5	65	Gravel	D. S		a 75
208	S. Anderson	1894	15 S.	3 E.	SW. ¼, 8	1½	75	+ 2.4			S. I		b 1

a Gallons per day.

b Gallons per minute.

c Plugged.

Data concerning wells in Sanpete and Sevier valleys, Utah—Continued.

No.	Name.	Year sunk.	Location.			Diameter.	Depth.	Height of water.	Depth to main water bed.	Nature of main water bed.	Use.	Yield.
			Township.	Range.	Section.							
						Inches.	*Feet.*	*Feet.*	*Feet.*			
209	S. Anderson	1894	15 S...	3 E....	SW. ¼, 8.....	1¼	118	+ 2.7	118	Gravel.....	S. I.....	.....
210	M. Sorenson	1890	15 S...	3 E....	SW. ¼, 9.....	1¼	18±	− 4.5	15	Sand.....	D. S.....	a 200
211	M. Madsen	1879	15 S...	3 E....	SE. ¼, 9.....	.....	11	− 6	5	Gravel.....	D. S.....	a 75
212	S. Jensen	1901	15 S...	3 E....	SE. ¼, 9.....	.....	15	−11	10	Sand.....	D. S.....	a 100
213	E. Bertram	1895	15 S...	3 E....	SW. ¼, 10.....	.....	27	−25	26	Gravel.....	D. S.....	a 350
214	B. Neilson	1890	15 S...	3 E....	NW. ¼, 10.....	.....	35	−29	32	.....do.....	S	a 50
215	M. Draper	1890	15 S...	3 E....	NE. ¼, 9.....	.....	65	−51	51	Sandstone	D. S.....	a 150
216	J. Syme	1880	15 S...	3 E....	SE. ¼, 9.....	.....	58	−53	57	.....	D. S.....	a 100
217	H. Christensen	1885	15 S...	3 E....	SE. ¼, 9.....	.....	38	−33	38	Limestone.....	D. S.....	a 150
218	S. R. Neilson	1895	15 S...	3 E....	NE. ¼, 10.....	.....	26	−21	21	Gravel.....	D. S.....	a 100
219	P. P. Draper	1895	15 S...	3 E....	SE. ¼, 10.....	.....	10	− 6	9	Gravel and sand..	D. S.....	a 300
220	A. Johannsen	1899	15 S...	4 E....	SW. ¼, 7.....	1¼	100	− 6±	100	Gravel.....	.....	.....
221	.....do.....	1891	15 S...	4 E....	SW. ¼, 7.....	.....	13	− 8	11	.....do.....	.....	.....
222	C. F. Peel	1889	15 S...	4 E....	SW. ¼, 8.....	1¼	50	+ 3.2	45	.....do.....	D. S. I.....	b 9
223	J. Bigler	1885	15 S...	4 E....	NE. ¼, 10.....	.....	13	− 6	10	.....do.....	D. S.....	a 100
224	J. Burton	1896	15 S...	4 E....	SW. ¼, 2.....	.....	52	−49	52	.....do.....	D. S.....	a 100
225	A. Paulson	1899	15 S...	4 E....	NW. ¼, 2.....	.....	84	−74	82	.....do.....	D. S.....	a 75
226	S. Jacobson	1875	15 S...	4 E....	NW. ¼, 3.....	.....	39	−30	35	.....do.....	D. S.....	a 75
227	E. Davidson	1903	15 S...	4 E....	NW. ¼, 4.....	.....	20	−16	17	.....do.....	D. S.....	a 250
228	N. P. Neilson	1895	15 S...	4 E....	NW. ¼, 5.....	2	133	.....	130	Clay and rock	I.....	b 1
229	Jos. Seely	1900	15 S...	4 E....	SE. ¼, 5.....	.....	18.5	−17	17	Gravel.....	D. S.....	a 350
230	L. Johnson	1899	15 S...	3 E....	SW. ¼, 4.....	1¼	55±	+ 3.5	52	.....do.....	S	b 1¼
231	W. Draper	1904	15 S...	3 E....	SW. ¼, 6.....	1¼	80	−10±	80	Sand and gravel..	D. S.....	a 150
232	J. C. Stark	1895	15 S...	3 E....	NW. ¼, 6.....	.....	47	−46	46	Gravel.....	D. S.....	a 60
233	A. Mirley	1900	14 S...	3 E....	SW. ¼, 33.....	1¼	56	− .8	56	.....do.....	.....	b ¼
234	D. C. Madson	1875	14 S...	4 E....	SW. ¼, 34.....	.....	45	− 36	42	.....do.....	D. S.....	a 200
235	P. Jacobson	1904	14 S...	3 E....	NE. ¼, 29.....	.....	13	−10	10	Sand	D. S.....	a 200
236	S. E. Jensen	1894	14 S...	4 E....	NE. ¼, 27.....	.....	11	−10	10	Sand and gravel..	D. S.....	a 50
237	.....do.....	1896	14 S...	4 E....	SE. ¼, 22.....	2	132	+	132	Sandstone	D. S.....	b 3
238	Zabriskie & Co	1903	14 S...	4 E....	NE. ¼, 21.....	(?)	(?)	.....	160	.....	.....	.....
239	G. W. Ivory	1894	14 S...	3 E....	NW. ¼, 19.....	1¼	205	+ 3	60	Sand	.....	.....
240	C. C. Livingston	1904	14 S...	3 E....	SW. ¼, 19.....	.....	30	−27	27	Gravel.....	D. S.....	a 100
241	J. C. Livingston	1895	14 S...	2 E....	SE. ¼, 14.....	.....	54	− 53	53	.....do.....	.....	.....
242	J. Otteson	1895	14 S...	2 E....	SE. ¼, 13.....	.....	17	− 16	11	.....do.....	S	a 150
243	H. C. Hansen	1893	14 S...	2 E....	NE. ¼, 13.....	(?)	71	+ 4.2	60	Gravel and sand..	S	b 1—
244	J. M. Allred	1905	14 S...	4 E....	NE. ¼, 11.....	.....	10	− 5	8	Clay	D.....	a 50
245	C. Otteson	1896	14 S...	3 E....	NE. ¼, 7.....	.....	27	−23	22	Gravel.....	D. I.....	a 150
246	A. Anderson	1885	14 S...	3 E....	SW. ¼, 6.....	.....	42	−38	30	.....do.....	D.....	a 75
247	O. C. Anderson	1903	14 S...	3 E....	SW. ¼, 5.....	.....	53	46.5	53	.....do.....	D. S.....	a 150
248	L. Neilson	1873	14 S...	2 E....	SW. ¼, 6.....	.....	15	−12	10	.....do.....	D. S.....	a 125
249	H. C. Hansen	1890	14 S...	2 E....	SE. ¼, 1.....	.....	11	− 6	6	.....do.....	D.....	a 75
250	A. Frandsen	1905	14 S...	3 E....	NE. ¼, 1.....	.....	26	−24	25	.....do.....	D.....	a 75

252	Fountain Green town well	1896	14 S.	3 E.	NW. ¼, 6	2	285	−3	200	do			[a] 200
253	J. H. Robertson	1896	14 S.	3 E.	NW. ¼, 6		31	−29	29±	do	D		[a] 75
254	C. Bristol	1901	14 S.	3 E.	NW. ¼, 6		42	40	40±	do	D		[a] 75
255	C. Larsen	1900	13 S.	3 E.	SW. ¼, 31		39	−36	36±	do	D		[a] 50
256	A. Christensen	1892	14 S.	4 E.	SE. ¼, 2		32	−22	28	do	D. S		[a] 100
257	A. B. Cox	1875	14 S.	4 E.	SW ¼, 2		29	−20	27	do	D		[a] 150
258	H. Jones	1897	13 S.	4 E.	SE. ¼, 35		72	−67	71	do	D. S		[a] 50
259	O. Miner	1903	13 S.	5 E.	SE. ¼, 31		12	−9	10		D		[a] 50
260	C. Hartley	1903	13 S.	4 E.	SE. ¼, 24		41	−36	40	Gravel	D		[a] 200
261	N. Hansen	1900	13 S.	4 E.	SW. ¼, 24		35	−30	33	do	D. S		[a] 350
262	R. Graham	1899	13 S.	4 E.	SE. ¼, 11		36	−27	33	do	D. S		[a] 75
263	O. J. Terry	1903	13 S.	4 E.	NE. ¼, 12		35	−33	33	Clay	D. S		[a] 75
264	W. E. Mowers	1898	13 S.	4 E.	NW. ¼, 1		59	−50	58	Gravel and clay	D. S		

[a] Gallons per day. [b] Gallons per minute.

Data concerning springs in Sanpete and Sevier valleys, Utah.

No.	Name.	Location. T.	R.	Sec.	Temperature.	Use.[a]	Yield.	Occurrence.
					°F.			
1	Sevier	25 S.	4 W.	NE. ¼, 32	59.	D. S.	[b] 100±	In gravel near bed of creek.
2	N. Johnson	25 S.	3 W.	NE. ¼, 27	80	S. I.	[b] 180	In igneous rock along fault.
2a		25 S.	3 W.	SW. ¼, 23	50	D. I.	[b] 22 and 11	Near creek bed.
3	Joseph	25 S.	4 W.	NE. ¼, 23	135 to 146	I.	[b] 30±	In calcareous tufa at base of igneous ridge.
4	T. J. Jukes	25 S.	3 W.	NE. ¼, 15		D. S. I.	[b] 17	4, 5, and 5a occur along fault at base of Sevier Plateau.
5	T. Cooper	25 S.	3 W.	SE. ¼, 10	144 to 156	D. I.	[b] 60±	
5a		25 S.	3 W.	NW. ¼, 11	154	I.		
6	Jericho	25 S.	3 W.	SW. ¼, 6	65	I.	[b] 670	Marsh near river bed.
7	Collar and Neilson	24 S.	3 W.	NW. ¼, 25	58.5	D. S. I.	[b] 25±	Igneous débris at base of foothills.
8	Red Butte	24 S.	2 W.	SW. ¼, 29	49	D. S. I.	[b] 18±	In bed of canyon at base of mountains.
9	L. Thomson	24 S.	3 W.	SW. ¼, 24	56	D. S. I.	[b] 35±	Igneous débris at base of foothills.
10		24 S.	4 W.	SW. ¼, 14	52	S	[b] 6±	Several feeble seep springs.
10a	Rock	24 S.	4 W.	11		S		On lava and tuff-capped hills northwest of Elsinore.
11		23 S.	2 W.	NE. ¼, and SE. ¼, 33.	52 to 61	S. I.	[b] 4,500±	Group of springs along west base of ridge of igneous rock.
11a		24 S.	2 W.	NW. ¼, and SW. ¼, 4.				
12	Glenwood	23 S.	2 W.	SW. ¼, 36	57	D. S. I.	[b] 3,285	In débris at west base of lava-capped ridge.
13	Parcel Creek	23 S.	2 W.	SW. ¼, 25	60	D. S. I.	[b] 60±	In igneous débris at base of ridge.
14	Indian	23 S.	2 W.	NW. ¼, 25	60	D. S. I.	[b] 75±	Do.
15	Cove	23 S.	2 W.	SW. ¼, 27	60	S. I.	[c] 9	Group of springs at northeast end of ridge of igneous rock.
16	Richfield	23 S.	3 W.	NE. ¼, 26	74	D. S. I.	[b] 1,440	Joints in limestone along fault.
17	Herrins Hole	23 S.	2 W.	NW. ¼, 23	63	S. I.	[b] 450±	In igneous débris at base of ridge.
18	Wall	23 S.	2 W.	SE. ¼, 15	52	D. S. I.	[b] 40±	In clay in Cove Creek bottoms.
19	Black Knoll	23 S.	2 W.	NW. ¼, 12	55	D. S. I.	[c] 12.5	In débris at base of igneous knoll.
20	Rocky Ford	22 S.	2 W.	SE. ¼, 36		I.	[c] 35	Seep springs in bed of Sevier River.
21	Christianson	22 S.	2 W.	SW. ¼, 1	59	S	[b] 15±	Débris on hillside.
22	Oak	22 S.	2 W.	NE. ¼, 1	61	S	[b] 3±	Do.
22a	Mud	21 S.	1 W.	NW. ¼, 20	53	S	[b] 12	
23	Salt	21 S.	1 E.	SW. ¼, 17	72		[b] 1½ ±	In débris at base of Jurassic hills.
24	Redmond	21 S.	1 W.	NE. ¼ & SE. ¼, 11. NW. ¼ & SW. ¼, 12.	60 70	D. S. I.	[c] 13.5	Group of springs in Redmond Lake.
25		20 S.	2 E.	SE. ¼, 32	58	S. I.	[b] 15±	Débris near creek.
26	Mayfield	19 S.	2 E.	SE. ¼, 33	50	I.	[c] .14±	In clay near creek bed.
27	Carlsons	19 S.	2 E.	SW. ¼, 20	52	S. I.	[b] 90±	In meadow.
28	Spannard	19 S.	2 E.	SE. ¼, 20	51.5	D. S. I.	[c] 1.75	Along fault (?) at base of monocline.
29	Robbins	19 S.	1 E.	NW. ¼, 23	57	I.	[b] 60±	In meadow.
30		19 S.	2 E.	SW. ¼, 18	54	I.	[c] .15+	Near creek bed.
31		19 S.	2 E.	SW. ¼, 18	49 to 50	I.	[c] 5	Do.
32	Tiltons	19 S.	2 E.	SW. ¼, 18	53 to 58	D. S. I.	[b] 180 + [b] 8 +	Do.
33	Gunnison	19 S.	1 E.	SE. ¼, 18	61	S		Do.

39	Barithwaite	18 S.	2 E.	SE. ¼, 34	55, 56		c 1.2	Along fault (?)
40	Funk's	18 S.	2 E.	SW. ¼, 33	50 to 53		c 1±	Near creek bed.
41	A. D. Squires	18 S.	2 E.	NE. ¼, 26	53	I.	b 7	In sandstone along fault (?).
42	Do	18 S.	2 E.	SE. ¼, 23	56, 59.5	I.	b 20	Do.
43	Saleratus	18 S.	2 E.	SW. ¼, 22	54	I.	c 1¼±	In débris along fault (?).
44	Lowry	18 S.	2 E.	NE. ¼, 23	62	I.	b 20	Do.
45	Livingston Warm	18 S.	2 E.	SW. ¼, 13	73	D. S. I.	c 0.61	Do.
46	Livingston Sulphur	18 S.	2 E.	SW. ¼, 13	57 to 62		b 10±	Do.
47	City	18 S.	3 E.	NW. ¼, 17	57	D.	b 8	In débris at side of canyon.
48	Manti	18 S.	3 E.	NW. ¼, 17	59	D.	b 20±	Do.
49	Manti Silver	18 S.	3 E.	NW. ¼, 17	65	D.	b 12	Do.
50	Temple	18 S.	3 E.	NE. ¼, 7	57	D. I.	b 60±	In débris at base of hill.
51	Shumway	17 S.	3 E.	NE. ¼, 18		S. I.	b 65±	In meadow.
52		16 S.	2 E.	NE. ¼, 12	54	D. S. I.	b 6	In débris at base of mountain along fault (?).
53	Beck	15 S.	4 E.	SE. ¼, 31	51.5	D. S. I.	b 44	In meadow.
54	Larsen	15 S.	4 E.	SW. ¼, 32	51, 53	S. I.	b 20±	Do.
55	Ellis	15 S.	4 E.	NW. ¼, 32	57	D. S. I.	b 30	Near creek bed.
56	Harris	15 S.	4 E.	SW. ¼, 29	50	D. S. I.	b 27	In soil in Spring City.
57		15 S.	4 E.	SW. ¼, 29	50	D. S. I.	b 4±	In street in Spring City.
58	Ford	15 S.	4 E.	SW. ¼, 29	52	D. S. I.	b 16	In soil in Spring City.
59	Separator	15 S.	4 E.	SE. ¼, 30	52	D.	b 4±	In meadow.
60	Freeman	15 S.	4 E.	NW. ¼, 36	48.5	S. I.	b 20	In foothills.
61	Jensen	15 S.	5 E.	SE. ¼, 30	43	D. S.	b ¼	In débris at base of mountain.
62		15 S.	2 E.	N. ½, 24	57 to 60	D. S. I.	c 0.35	In débris at base of mountain along fault.
63		15 S.	2 E.	SW. ¼, 13	58	D. S. I.	c 0.08	In débris along fault.
64	Brewer's	15 S.	2 E.	NW. ¼, 13	62	D. S. I.	c 0.45	In débris at base of mountain along fault.
65	Proctor	15 S.	4 E.	SE. ¼, 12	51	D. S.	2.3	In débris at base of mountain.
66	A. Zabriskie	15 S.	4 E.	NW. ¼, 11	51	D. S. I.	20±	In sand in valley.
67	Sugar Factory	15 S.	4 E.	SW. ¼, 7	50 to 52	D. S. I.	c 3.8	In meadow.
68	Silver Creek	15 S.	3 E.	NE. ¼, 5	51	S. I.	c 0.6	Along creek bed in meadow.
69	Duck	15 S.	3 E.	SW. ¼, 4	54.5	S. I.	c 2.4	Group of small springs at base of hill.
70	Freedom	15 S.	2 E.	NE. ¼, 2	51.5	D. S. I.	c 0.97	In débris at base of mountain along fault.
71	L. Christensen	14 S.	2 E.	SE. ¼, 26	51.5	D. S. I.	c 0.15	Do.
72	Seely	15 S.	4 E.	SE. ¼, 5	48.5	S. I.	b 20±	In meadow.
73	Erickson & Seely	15 S.	4 E.	SE. ¼, 5	56	S. I.	b 270	Do.
73a	Snake	15 S.	4 E.	NE. ¼, 8	49 to 55	S. I.	c 0.9	Do.
74	Seely and Madsen tunnel	15 S.	4 E.	NW. ¼, 3	51	D. S. I.	c 0.21	Small seep, increased by tunneling.
75	Christian	15 S.	5 E.	SW. ¼, 6	45.5	D. S. I.	b 40	In débris on mountain side.
76	McArthur	14 S.	4 E.	SW. ¼, 28	54	S. I.	c 0.61	Seep near Sanpitch Creek.
77	Zabriskie South	14 S.	4 E.	NW. ¼, 27	51	D. S. I.	c 0.27	In meadow.
78	Zabriskie Small	14 S.	4 E.	NW. ¼, 27	55	I.	b 1.5	Do.
79	Crystal	14 S.	4 E.	NW. ¼, 27	49	D. S. I.	c 0.2	Do.
80	Jensen	14 S.	4 E.	SE. ¼, 22	48.5	S. I.	c 0.15+	Do.

a D.=Domestic; S.=Stock; I.=Irrigation. b Gallons per minute. c Second-feet.

Data concerning springs in Sanpete and Sevier valleys, Utah—Continued.

No.	Name.	Location. T.	R.	Sec.	Temperature.	Use.[a]	Yield.	Occurrence.
					°F.			
81	Hardy	14 S.	3 E.	NE. ¼ 23	55.5	D. I.	[b] 12	
82	Birch Creek	14 S.	2 E.	NE. ¼ 23	51	D. S. I.	[c] 1.53	In débris at base of mountain, along fault.
83	Miner	14 S.	4 E.	SW. ¼ 11	48	S. I.	[c] 0.25±	In meadow.
84	Alfred	13 S.	4 E.	NE. ¼ 11	50	S. I.	[c] 12.1	Do.
85	Spring Creek	13 S.	4 E.	NW. ¼ 12	46	S. I.		
86	Fountain Green	14 S.	2 E.	NW. ¼ 2	53	D. S. I.	[c] 12.37	In débris at base of mountain, along fault.
87		13 S.	4 E.	SE. ¼ 11	53	D. I.	[b] 20±	Near creek.
88	Spring Branch	13 S.	4 E.	SE. ¼ 2	47.5	D. S. I.	[c] 0.6	Do.

[a] D.—Domestic; S.—Stock; I.—Irrigation. [b] Gallons per minute. [c] Second-feet.

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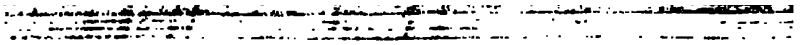

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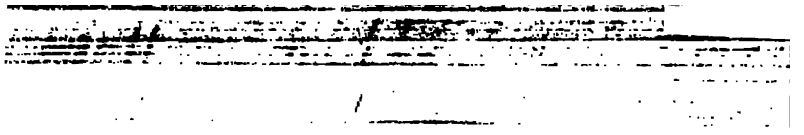

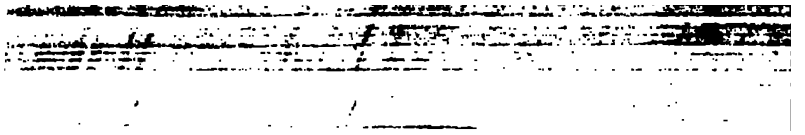

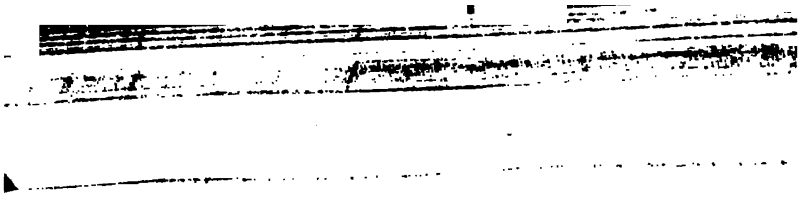

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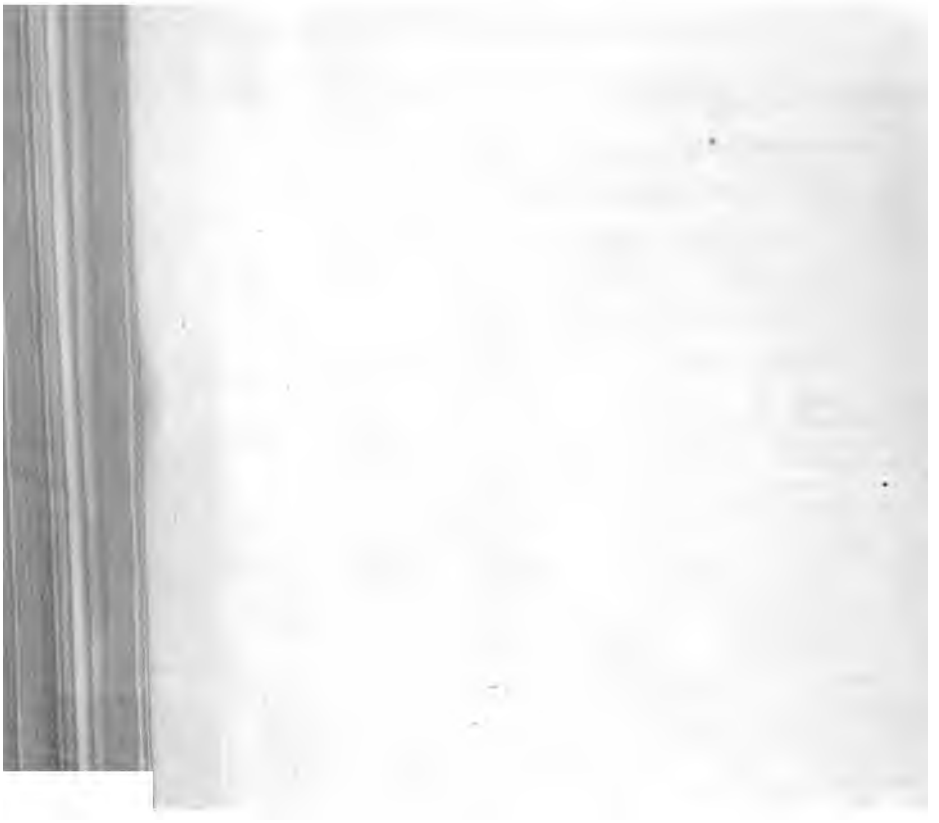

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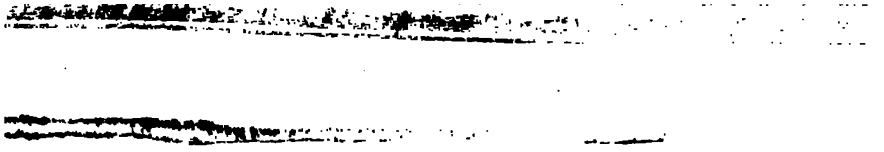

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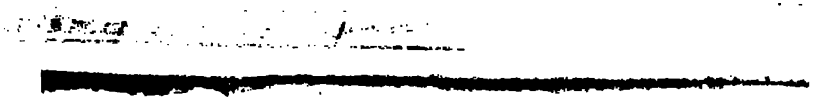

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WEIR EXPERIMENTS, COEFFICIENTS, AND FORMULAS.

By ROBERT E. HORTON.

INTRODUCTION.

DEFINITIONS OF TERMS.

The word "weir" will be used to describe any structure used to determine the volume of flow of water from measurements of its depth on a crest or sill of known length and form. In this general sense timber and masonry dams having various shapes of section, reservoir overflows, and the like may be weirs. Terms, more or less synonymous, used to describe such weirs are "comb," "wasteway," "spillway," "overwash," "rollway," and "overfall."

The French term "nappe," suggesting the curved surface of a cloth hanging over the edge of a table, has been fittingly used to designate the overfalling sheet of water.

The expression "wetted underneath" has been used to describe the condition of the nappe designated by Bazin as "noyées en dessous," signifying that the water level between the nappe and the toe of the weir is raised by vacuum above the general water level below the weir.

"Thin-edged weir" and "sharp-crested weir" are used to designate a weir in which the nappe, or overfalling sheet, touches only the smooth, sharp upstream corner or edge of the crest, the thickness of which is probably immaterial so long as this condition is fulfilled.

A "suppressed weir" has a channel of approach whose width is the length of the weir crest.

A "contracted weir" has a crest length that is less than the width of the channel of approach.

The term "channel of approach," or "leading channel," defines the body of water immediately upstream from the weir, in which is located the gage by which the depth of overflow is measured.

"Section of approach" may refer to the cross section of the leading channel, if the depth and width of the leading channel are uniform; otherwise it will, in general, apply to the cross section of the channel of approach in which the gage is located.

"Weir section" refers to the cross section of the overflowing stream in the plane of the weir crest.

"Crest contraction" refers to the diminished cross section of the overflowing stream resulting from the upward curvature of the lower water filaments in passing the crest edge. It does not include the downward curvature of the water surface near the weir crest.

The "vertical contraction of the nappe" includes both the crest contraction and the surface contraction.

"Incomplete contraction" may take place either at the crest or at the ends of a weir, and will occur when the bottom or side walls of the channel of approach are so near the weir as to prevent the complete curvature of the water filaments as they pass the contracting edge.

Dimensions are uniformly expressed in feet and decimals, velocities in feet per second, and quantities of flow in cubic feet per second, unless otherwise stated in the text.

In the preparation of this paper much computation has been involved and it is expected that errors will appear, which, if attention is called to them, may be corrected in the future. Information concerning such errors will be gratefully received.

NOTATION.

The symbols given below are used in the values indicated. The meaning of additional symbols as used and special uses of those that follow are given in the text:

D=Measured or actual depth on the crest of weir, usually determined as the difference of elevation of the weir crest and the water level, taken at a point sufficiently far upstream from the weir to avoid the surface curve.

H=The head corrected for the effect of velocity of approach, or the observed head where there is no velocity of approach. As will be explained, D is applied in formulas like Bazin's, in which the correction for velocity of approach is included in the coefficient. H is applied in formulas where it is eliminated.

v=Mean velocity of approach in the leading channel, usually taken in a cross section opposite which D is determined.

h=Velocity head=$\alpha\frac{v^2}{2g}$.

g=Acceleration by gravity. Value here used 32.16.

P=Height of weir crest above bottom of channel of approach, where channel is rectangular.

W=Width of channel of approach where D is measured.

A=Area of cross section of channel of approach.

G=Area of channel section where D is measured, per unit length of crest.

a=Area of weir section of discharge=DL.

L=Actual length of weir crest for a suppressed weir, or length corrected for end contractions, if any.

L'=Actual length of crest of a weir with end contractions.

N=Number of complete end contractions.

B=Breadth of crest of a broad-crested weir.

S=Batter or slope of crest, feet horizontal to one vertical.

d=Depth of crest submergence in a drowned or submerged weir.
Q=Volume of discharge per unit of time.
C, M, m, μ, α, f, etc., empirical coefficients.

BASE FORMULAS.

The following formulas have been adopted by the engineers named:

$Q=\frac{2}{3}MLH\sqrt{2g}H.$	Hamilton Smith (theoretical).
$=\mu LH\sqrt{2g}H.$	Bazin, with no velocity of approach.
$=mLD\sqrt{2g}D.$	Bazin, with velocity of approach.
$=CLH^{\frac{3}{2}}.$	Francis[a] (used here).
$=CLH^{\frac{3}{2}}+fL.$	Fteley and Stearns.

EQUIVALENT COEFFICIENTS.

The relations between the several coefficients, so far as they can be given here, are as follows:

$$\mu=\frac{2}{3}M.$$

M is a direct measure of the relation of the actual to the theoretical weir discharge.

$$C=\mu\sqrt{2g}=\frac{2}{3}M\sqrt{2g}=8.02\ \mu=5.35\ M.$$

$$M=\frac{3}{2}\mu=\frac{3}{2}\frac{C}{\sqrt{2g}}=0.1870\ C.$$

$$\mu=\frac{C}{8.02}=0.1247\ C.$$

APPROXIMATE RELATIVE DISCHARGE OVER WEIRS.

For a thin-edged weir, the coefficient C in the Francis formula is $3.33=\frac{10}{3}$. Let C'' be the coefficient for any other weir, and x the relative discharge as compared with the thin-edged weir, then

$$\frac{10}{3}:C''::1:x$$

$$x=\frac{3C''}{10} \quad \ldots\ldots\ldots\ldots \quad (1)$$

or, as a percentage,

$$x_1=100\,x=30\,C''.$$

[a] The coefficient C of Francis includes all the constant or empirical factors appearing in the formula, which is thus thrown into the simplest form for computation.

This expression will be found convenient in comparing the effect on discharge of various modifications of the weir cross section. For a broad-crested weir with stable nappe, $C_1=2.64$, see p. 121. The discharge over such a weir is thus seen to be 79.2 per cent of that for a thin-edged weir by the Francis formula.

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BAZIN, H., Expériences nouvelles sur l'écoulement en déversoir, 6me art., Annales des Ponts et Chaussées, Mémoires et Documents, 1898, 2me trimestre, pp. 121–264. This paper gives the results of experiments on weirs of irregular section. Bazin's earlier papers, published in Annales des Ponts et Chaussées, 1888, 1890, 1891, 1894, and 1896, giving results of experiments chiefly relating to thin-edged weirs and velocity of approach, have been translated by Marichal and Trautwine.

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THEORY OF WEIR MEASUREMENTS.

DEVELOPMENT OF THE WEIR.

The weir as applied to stream gaging is a special adaptation of mill dam, to which the term weir, meaning a hindrance or obstruction, has been applied from early times. The knowledge of a definite relation between the length and depth of overflow and the quantity also probably antedates considerably the scientific determination of the relation between these elements.

In theory a weir or notch[a] is closely related to the orifice; in fact, an orifice becomes a notch when the water level falls below its upper boundary.

THEOREM OF TORRICELLI.

The theorem of Torricelli, enunciated in his De Motu Gravium Naturaliter Accelerato, 1643, states that *the velocity of a fluid passing through an orifice in the side of a reservoir is the same as that which would be acquired by a heavy body falling freely through the vertical*

[a] Commonly applied to a deep, narrow weir.

height measured from the surface of the fluid in the reservoir to the center of the orifice.

This theorem forms the basis of hydrokinetics and renders the weir and orifice applicable to stream measurement. The truth of this proposition was confirmed by the experiments of Mariotte, published in 1685. It can also be demonstrated from the laws of dynamics and the principles of energy.[a]

ELEMENTARY DEDUCTION OF THE WEIR FORMULA.

In deducing a theoretical expression for flow over a weir it is assumed that each filament or horizontal lamina of the nappe is actuated by gravity acting through the head above it as if it were flowing through an independent orifice. In fig. 1 the head on the successive orifices being H_1, H_2, H_3, etc., and their respective areas A_1, A_2, A_3, etc., the total discharge would be

$$Q = M\sqrt{2g}\left[A_1 H_1^{\frac{1}{2}} + A_2 H_2^{\frac{1}{2}} \text{ to } + A_n H_n^{\frac{1}{2}}\right]. \quad . \quad . \quad . \quad . \quad (2)$$

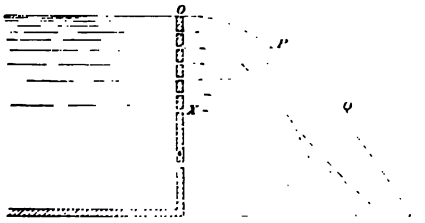

FIG. 1.—Torricellian theorem applied to a weir.

If the small orifices A be considered as successive increments of head H, the weir formula may be derived by the summation of the quantities in parentheses. H comprises n elementary strips, the breadth of each is $\frac{H}{n}$. The heads on successive strips are $\frac{H}{n}$, $\frac{2H}{n}$, etc., and the total becomes

$$Q = \frac{MLH}{n}\sqrt{2g}\left(\sqrt{\frac{H}{n}} + \sqrt{\frac{2H}{n}} + \sqrt{\frac{3H}{n}} + \right) \quad . \quad . \quad . \quad . \quad (3)$$

where $\frac{LH}{n} = A_1 + A_2$, etc., for a rectangular weir. The sum of the series $\sqrt{1}+\sqrt{2}+\sqrt{3}+$ to $\sqrt{n} = \frac{2}{3}n^{\frac{3}{2}}$.

Hence the discharge is

$$Q \quad \frac{MLH}{n}\sqrt{2g}\sqrt{\frac{H}{n}} \cdot \frac{2}{3}n^{\frac{3}{2}}.$$

$$\frac{2}{3}MLH\sqrt{2g}H.$$

The above summation is more readily accomplished by calculus.

[a] See Wood, Elementary Mechanics, p. 167, also p. 291.

APPLICATION OF THE PARABOLIC LAW OF VELOCITY TO WEIRS.

The following elementary demonstration clearly illustrates the character of the weir:

According to Torricelli's theorem (see fig. 1), the velocity (v) of a filament at any depth (x) below surface will be $v=\sqrt{2gx}$. This is the equation of a parabola having its axis OX vertical and its origin at water surface. Replacing the series of jets by a weir with crest at X, the mean velocity of all the filaments will be the average ordinate of the parabola OPQ. The average ordinate is the area divided by the height, but the area of a parabola is two-thirds that of the circumscribed rectangle; hence the mean velocity of flow through the weir is two-thirds the velocity at the crest, i. e., two-thirds the velocity due to the total head H on the crest. The discharge for unit length of crest is the head H, or area of opening per unit length, multiplied by the mean velocity. This quantity also represents the area of the parabolic velocity curve $OPQX$. The mean velocity of flow in the nappe occurs, theoretically, at two-thirds the depth on the crest.

The modification of the theoretical discharge by velocity of approach, the surface curve, the vertical contraction at the crest, and the various forms that the nappe may assume under different conditions of aeration, form of weir section, and head control the practical utility of the weir as a device for gaging streams.

GENERAL FORMULA FOR WEIRS AND ORIFICES.[a]

Consider first a rectangular opening in the side of a retaining vessel. The velocity of flow through an elementary layer whose area is Ldy will be from Torricelli's theorem:

$$v=\sqrt{2gy}.$$

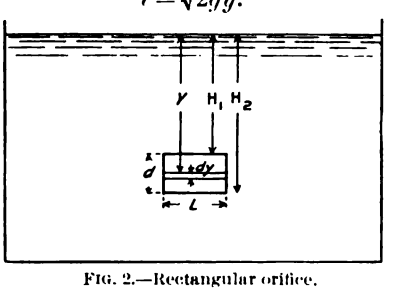

FIG. 2.—Rectangular orifice.

The discharge through the entire opening will be, per unit of time neglecting contractions,

$$Q=\int_{H_1}^{H_2}\sqrt{2gy}\cdot L\,dy \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4$$

[a] For correlation of the weir and orifice see Merriman, Hydraulics, 8th edition, 1903, p. 144.

This is a general equation for the flow through any weir or orifice, rectangular or otherwise, Q being expressed as a function of y. In the present instance L is constant. Integrating,

$$Q=\frac{2}{3}L\sqrt{2g}\left(H_2^{\frac{3}{2}}-H_1^{\frac{3}{2}}\right). \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

For a weir or notch, the upper edge will be at surface, $H_1=0$, and calling $H_2=H$ in equation (5),

$$Q=\frac{2}{3}L\sqrt{2g}\ H^{\frac{3}{2}}. \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

In the common formula for orifices, only the head on the center of gravity of the opening is considered.

Expressing H_2 and H_1 in terms of the depth H on the center of gravity of the opening and the height of opening d, Merriman obtains, after substituting these values in and expanding equation (5) by the binomial theorem, the equivalent formula,

$$Q=dL\sqrt{2g}H^{\frac{3}{2}}\left[1-\frac{1}{96}\frac{d^2}{H^2}-\frac{1}{2048}\frac{d^4}{H^4}-\frac{1}{21845}\frac{d^6}{H^6}, \text{ etc.}\right] \quad . \quad . \quad (7)$$

The sum of the infinite series in brackets expresses the error of the ordinary formula for orifices as given by the remainder of the equation. This error varies from 1.1 per cent when $H=d$ to 0.1 per cent when $H=3d$.

VERTICAL CONTRACTION.

Practical weir formulas differ from the theoretical formula (6) in that velocity of approach must be considered and the discharge must be modified by a contraction coefficient to allow for diminished section of the nappe as it passes over the crest lip. Velocity of approach is considered on pages 14 to 20. Experiments to determine the weir coefficient occupy most of the remainder of the paper. The nature of the contraction coefficient is here described.

Vertical contraction expresses the relation of the thickness of nappe, s, in the plane of the weir crest, to the depth on the crest, H. If the ratio $s\ H$ were unity, the discharge would conform closely with the expression

$$Q=2.3\ LH\sqrt{2g}H.$$

The usual coefficient in the weir formula expresses nearly the ratio $s\ H$.

The vertical contraction comprises two factors, the surface curve or depression of the surface of the nappe and the contraction of the under surface of the nappe at the crest edge. The latter factor in

particular will vary with form of the weir cross section, and in general variation in the vertical contraction is the principal source of variation in the discharge coefficient for various forms of weirs.

The usual base weir formula, $Q=2/3\ LH\sqrt{2gH}$, is elsewhere given for an orifice in which the upper edge is a free surface. If instead the depth on the upper edge of the orifice is d, the surface contraction, there results the formula

$$Q=\frac{2}{3}ML\sqrt{2g}\left(H^{\frac{3}{2}}-d^{\frac{3}{2}}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

This is considered as the true weir formula by Merriman.[a] In this formula only the crest-lip contraction modifies the discharge, necessitating the introduction of the coefficient. The practical difficulties of measuring d prevent the use of this as a working formula.

Similarly a formula may be derived in which only the effective cross section s is considered, but even this will require some correction of the velocity. Such formulas are complicated by the variation of s and d with velocity of approach.[b] Hence, practical considerations included, it has commonly been preferred to adopt the convenient base formula for weirs, $Q=\frac{2}{3}\ MLH\sqrt{2gH}$, or an equivalent, and throw all the burden of corrections for contraction into the coefficient M.

VELOCITY OF APPROACH.

THEORETICAL FORMULAS.

Before considering the various practical weir formulas in use some general considerations regarding velocity of approach and its effect on the head and discharge may be presented.

In the general formula (4) for the efflux of water when the water approaches the orifice or notch with a velocity v, then with free discharge, writing $D+h$ in place of H, for a rectangular orifice, we have

$$Q=\int_{D_1+h}^{D_2+h}\sqrt{2gy}\ .\ Ldy \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

D_1 and D_2 being the measured depth on upper and lower edges of the orifice, and $h=\frac{v^2}{2g}$, the velocity head.

To assume that $D+h$ equals H is to assume that the water level is

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[a] Hydraulics, 8th edition, p. 161.

[b] See Trautwine and Marichal's translation of Bazin's Experiments, pp. 231-307, where may also be found other data, including a résumé of M. Boussinesq's elaborate studies of the vertical contraction of the nappe, which appeared in Comptes Rendus de l'Académie des Sciences for October 24, 1887.

increased by the amount h, or, as is often stated, that H is "measured to the surface of still water." This is not strictly correct, however, because of friction and unequal velocities, which tend to make $H-D>h$, as explained below.

For a weir, D_1 equals zero; integrating,

$$Q=\frac{2}{3}L\sqrt{2g}\left[(D+h)^{\frac{3}{2}}-h^{\frac{3}{2}}\right]$$

Since $Q=\frac{2}{3}L\sqrt{2g}H^{\frac{3}{2}}$, we have

$$H=\sqrt[3]{(D+h)^{\frac{3}{2}}-h^{\frac{3}{2}}}^{\frac{2}{3}} \quad . \quad . \quad . \quad . \quad . \quad (9a)$$

This is the velocity correction formula used by James B. Francis.[a]

Since h appears in both the superior and inferior limits of integration, it is evident that h increases the velocity only, and not the section of discharge. The criticism is sometimes made that Francis's equation has the form of an increase of the height of the section of discharge as well as the velocity.

The second general method of correcting for velocity of approach consists of adding directly to the measured head some function of the velocity head, making

$$H=D+\alpha h$$

in the formula

$$Q=CLH\sqrt{2g}H$$

or

$$Q=CL(D+\alpha h)\sqrt{2g(D+\alpha h)}. \quad . \quad . \quad . \quad . \quad . \quad 9b$$

This is the method employed by Boileau, Fteley and Stearns, and Bazin. No attempt is made to follow theory, but an empirical correction is applied, affecting both the velocity and area of section.

By either method α must be determined by successive approximations unless it has been directly measured.

Boileau and Bazin modify (9b) so as to include the area of section of channel of approach, and since the velocity of approach equals $Q \div A$, a separate determination of α is unnecessary. Bazin also combines the factor for velocity of approach with the weir coefficient.

The various modifications of the velocity correction formulas are given in conjunction with the weir formulas of the several experimenters.

[a] Bovey gives similar proof of this formula for the additional cases of (1) an orifice with free discharge, (2) a submerged orifice, (3) a partially submerged orifice or drowned weir, thus establishing its generality.

DISTRIBUTION OF VELOCITY IN CHANNEL OF APPROACH.

The discharge over a weir takes place by virtue of the potential energy of the layer of water lying above the level of the weir crest, which is rendered kinetic by the act of falling over the weir. If the water approaches the weir with an initial velocity, it is evident that some part of the concurrent energy will facilitate the discharge.

The theoretical correction formulas may not truly represent the effect of velocity of approach for various reasons:

1. The fall in the leading channel adjacent to the measuring section is the source of the velocity of approach, and this fall will always be greater than that required to produce the existing velocities, because some fall will be utilized in overcoming friction.

2. The velocity is seldom uniform at all parts of the leading channel and the energy of the water varies accordingly. This effect is discussed later (p. 17).

3. It is not certain just what portion of the energy of the water in the section of the leading channel goes to increase the discharge.

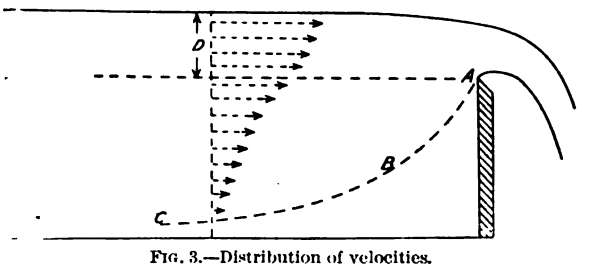

FIG. 3.—Distribution of velocities.

In general the threads of the water in the cross section of the channel of approach to a weir have varying velocities. It follows that, as will be shown, the ratio of the actual energy of the approaching water to the energy due to the mean velocity will be greater than unity, and for this reason the correction for velocity of approach will be greater than if the energy were that due to a fall through a head produced by the mean velocity v. The more nearly uniform is the velocity of the water in the leading channel the smaller will be the necessary coefficient α in the velocity head formula. The velocity may be rendered very nearly uniform by the use of stilling racks or baffles. Where this was done in the experiments on which a formula was based (that of Francis, for example) a larger velocity of approach correction than that obtained by the author may be necessary in applying the formula to cases where there is wide variation in the velocity in the leading channel. To avoid such a contingency it is desirable, when practicable, to measure head to surface of still water, because more accurate results can be obtained and wash against instruments prevented.

The vertical and horizontal velocity curves in an open channel usually closely resemble parabolas. A weir interposes an obstruction in the lower part of the channel, checking the bottom velocities. The velocity is not, however, confined to the filaments in line with the section of the discharge opening of the weir. As a result of viscosity of the liquid, the upper rapidly moving layers drag the filaments underneath, and the velocity may extend nearly or quite to the channel bottom. There will usually, however, be a line (A B C, fig. 3), rising as the weir is approached, below which there is no forward velocity.

The line A B C is the envelope of the curves of vertical velocity in the channel of approach.

There will be a similar area of low velocity at each side of the channel for a contracted weir. The inequality of velocities for such weirs being usually greater than for suppressed weirs, it follows that a larger coefficient in the formula for velocity of approach may be required. This is confirmed by experiment.

Various assumptions have been made as to what portion of the energy of the approaching stream goes to increase the discharge, (*a*) that resulting from the mean velocity deduced from the discharge divided by the area of the entire section of the channel of approach; (*b*) that of the mean velocity obtained by using the sectional area of the moving water, above the line A B C, fig. 3; (*c*) that of the filaments lying in line with or nearest to the section of the weir opening, determined approximately by the surface velocity.[a]

DISTRIBUTION OF ENERGY IN CHANNEL OF APPROACH.

Consider unit width of the channel of approach:

Let v_s = Surface velocity.
v_m = Mean velocity.
v_b = Bottom velocity.
v = Velocity at a height x above bottom.
Y = Depth of water in channel of approach.
w = Weight of unit volume.

The general formula for kinetic energy is

$$\text{K. E.} = \frac{Wv^2}{2g} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

where W = weight of the moving mass.

If the velocity increases uniformly from bottom to surface, the velocity at height x will be

$$v = v_b + \frac{x}{Y}(v_s - v_b).$$

[a] Smith, Hamilton, Hydraulics, p. 68.

Let dx be the thickness of a lamina one unit wide at height x. The total kinetic energy for the depth X will be

$$\text{K. E.} = \int_0^X \left(v_b + \frac{x}{X}(v_s - v_b)\right)^3 \frac{w}{2g}\, dx \quad . \quad . \quad . \quad . \quad (11)$$

If the velocity is uniform, the total kinetic energy per unit width is found by integration to be

$$\text{K. E.} = \frac{w X v_m^3}{2g} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (12)$$

Integrating equation (11) for the case where $v_b = 0$ and the velocity increases uniformly from the bottom to the surface so that $v_m = \frac{v_s}{2}$,

$$\text{K. E.} = \frac{w X v_m^3}{g} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (13)$$

Comparing this with the expression for kinetic energy of a stream flowing with the uniform velocity v (equation 12), we find the mass energy of the stream with uniformly varying velocity to be twice that of a stream with a uniform velocity of the same measured value.

By a similar integration the ratio of the total kinetic energy to the kinetic energy corresponding to the mean velocity in the channel of approach can be obtained for any assumption as to the distribution of velocities in the leading channel. The resulting ratio will depend upon the relative areas of section with low and high velocities which go to make up the mean, and in practice it will generally exceed unity.

The lowering of the water surface in a still pond will also be greater in the case of unequal velocities than in the case of a uniform velocity equal to their mean. The theoretical weir formula indicates the same discharge for a uniform velocity of approach v as for varying velocities whose mean is v, although in the former case the actual drawing down of the head would be greater. If h were the velocity head corresponding to the mean velocity, and if v_1, v_2, v_3, etc., v_n were the actual velocities in the n unit areas of cross section the discharge each unit section will be proportional to the velocity, and the head will have such a value that

$$\frac{w}{2g}(v_1^3 + v_2^3 + v_3^3 + \text{etc. } v_n^3) = wQh' = \text{Integral K. E.}$$

Now, $\frac{wQ}{2g}v^2 = wQh = \text{K. E.}$ for uniform velocity of the same mean value, the friction head being neglected in both cases. As shown above, the integral K. E. is the greater.

It follows that $h' > h$. If $\alpha = \frac{h'}{h}$, then $h' = \alpha h$.

Introducing velocity of approach in the discharge formula we substitute $D+h$ for H, and integrate between the limits zero and D. Hence, for the same discharge, the area of weir section is greater without velocity of approach by nearly the amount hL.

For a given measured head D, the effect of velocity of approach appears as an increase in the mean velocity of discharge in the plane of the weir. The relation of the mean velocity of discharge for a weir with velocity of approach to that for a weir without such velocity is shown below. The mean head being the same and the mean velocity in the plane of the weir being $\frac{Q}{D}$,

then $$\frac{Q}{D} : \frac{Q_1}{D} :: D^{\frac{3}{2}} : (D+h)^{\frac{3}{2}} - h^{\frac{3}{2}}.$$

It will be seen that a discharge over a weir with velocity of approach is less than that for the same total head and greater than that for the same measured head without velocity of approach, and that with a given measured head the greater the velocity of approach the greater will be the discharge.

The kinetic energy of a mass of water remains sensibly constant while the water is passing through a leading channel of uniform cross section, for with a constant stage kinetic energy can increase or decrease only through a change of slope or through fluid friction. The former is nearly absent and the latter can cause only a slow transfer of energy. If in the leading channel the velocities in the vertical plane that are originally unequal become equalized, there must be an increase in the mean velocity of the mass of water, for otherwise the kinetic energy per unit mass will decrease. It follows that the mean velocity will increase although the mean kinetic energy per unit mass remains constant, and hence the total kinetic energy of the water passing over the weir will increase in the same proportion as the velocity and discharge. For two cases in which the mean velocity is the same, but in which the velocities in the leading channels are uniform in the first case and nonuniform in the second, let the weights of water passing over the weir per second be represented respectively by W and W' and the kinetic energies by K. E. and K. E.'; then since K. E. $= Wh$, h being the head due to the mean velocity v.

$$Wh : W'h :: \text{K. E.} : \text{K. E.}'$$

It follows that an equalization of the velocities in the channel of approach by means of racks or baffles may cause an increase in the discharge, the measured head D remaining the same.

This will be clearer if we consider two contiguous filaments, each having unit section a, one with a velocity of 1 foot, the other of 2 feet

per second. The two will discharge 2+1 units flow per second, having the total kinetic energy indicated below:

$$\text{K. E.} = \frac{1\times 1^2}{2g} aw + \frac{2\times 2^2}{2g} aw = 9\frac{aw}{2g}.$$

If the velocities are equalized, 9 units of energy will be equally divided between the two filaments, so that, the new velocity being v,

$$\frac{2awv\times v^2}{2g} = \frac{9aw}{2g}$$

and

$$v = \sqrt[3]{\frac{9}{2}} = 1.651.$$

The average velocity before equalization was 1.5.

The discharge from two filaments with equal velocities will be 3.302 units, and 3.00 from two filaments with unequal velocities.

THE THIN-EDGED WEIR.

EARLIER EXPERIMENTS AND FORMULAS.

Prior to 1850 the practice of weir measurement was in a somewhat chaotic condition, especially in England, Germany, and the United States. Experiments were made on so small a scale that the influences affecting the measurements and the lack of proper standards made the results untrustworthy in detail. Greater advancement had been made in France, and some of the work of the early French experimenters has proved to be of considerable value.

EXPERIMENTS OF CASTEL.

The first experiments deserving consideration are of those of M. Castel, conducted at the waterworks of Toulouse in 1835 and 1836.[a] Castel erected his apparatus on a terrace in conjunction with the water tower, which received a continuous supply of 1.32 cubic feet per second, capable of being increased to 1.77 cubic feet per second. The weir consisted of a wooden dam, surmounted by a crest of copper 0.001 foot in thickness, situated in the lower end of a leading channel 19.5 feet long, 2.428 feet wide, and 1.772 feet deep. Screens were placed across the upper end of the channel to reduce oscillations. The head was measured at a point 1.60 feet upstream from the weir by means of a point gage. The overflow was measured in a zinc-lined tank having a capacity of 113.024 cubic feet. The length of the crest

[a] Originally published in Mémoires Acad. Sci. Toulouse, 1837. See D'Aubuisson's Hydraulics, Bennett's translation, pp. 74–77. Data recomputed by Hamilton Smith in his Hydraulics, pp. 80–82 and 138–145. The recomputed coefficients will be found valuable in calculating discharge for very small and very low weirs.

for weirs with suppressed contractions varied from 2.393 to 2.438 feet. Heights of weirs varying from 0.105 to 0.7382 were used, and a similar series of experiments was performed on suppressed weirs 1.1844 feet long. The head varied for the longer weirs from about 0.1 to 0.25 foot. Additional experiments were made on contracted weirs having various lengths, from 0.0328 foot to 1.6483 feet, in a channel 2.428 feet wide, and for lengths from 0.0328 to 0.6542 foot in a channel 1.148 feet wide. The experiments on these weirs included depths varying from 0.1 or 0.2 foot to a maximum of about 0.8 foot.

D'Aubuisson gives the following formula, derived from the experiments of Castel for a suppressed weir:

$$Q=3.4872LD\sqrt{D+0.035\ W^2} \quad . \quad . \quad . \quad . \quad . \quad (14)$$

where W is the measured central surface velocity of approach, ordinarily about $1.2v$.

EXPERIMENTS OF PONCELET AND LESBROS.

The experiments made by Poncelet and Lesbros, at Metz, in 1827 and 1828, were continued by Lesbros in 1836. The final results were not published, however, until some years later.[a]

The experiments of Poncelet and Lesbros and of Lesbros were performed chiefly on a weir in a fixed copper plate, length 5.562 feet. The head was measured in all cases in a reservoir 11.48 feet upstream, beyond the influence of velocity of approach. The crest depth varied from about 0.05 to 0.60 or 0.80 foot. The experiments of Lesbros are notable from the fact that a large number of forms of channel of approach were employed, including those with contracted and convergent sides, elevated bottoms, etc. They have been carefully recomputed by Hamilton Smith, and may be useful in determining the discharge through weirs having similar modifications.[b]

EXPERIMENTS OF BOILEAU.

The experiments of Boileau[c] at Metz, in 1846, included 3 suppressed weirs, having lengths and heights as follows:

(1) Length 5.30 feet, height 1.54 feet.
(2) Length 2.94 feet, height 1.12 feet.
(3) Length 2.94 feet, height 1.60 feet.

The depth of overflow varied from 0.19 to 0.72 foot. Boileau obtained the following formula for a suppressed weir:

$$Q=3.3455\ \frac{P+D}{\sqrt{(P+D)^2-D^2}}\ LD^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad (15)$$

[a] Expériences hydrauliques sur les lois de l'écoulement de l'eau, Paris, 1852.
[b] Smith, Hamilton, Hydraulics, pp. 96 and 97 and 104–107. Also plates 1–2 and 8.
[c] Gaugeage de cours d'eau, etc., Paris, 1850.

This formula includes the correction for velocity of approach. The coefficient C, it will be noticed, is given as a constant. Boileau afterwards gave a table of corrections varying with the depth, indicating a discharge from 96 to 107 per cent of that obtained with the constant coefficient. Additional experiments by Boileau on suppressed weirs having a crest length of about 0.95 foot have been recomputed by Hamilton Smith.[a] The heights of weirs were, respectively, 2.028, 2.690, 2.018, and 2.638 feet. In these experiments the discharge was determined by measurement through orifices.

EAST INDIAN ENGINEERS' FORMULA.[b]

The East Indian engineers' formula for thin-edged weirs is

$$\left.\begin{aligned} Q&=\frac{2}{3}\,ML\sqrt{2g}H^{\frac{3}{2}}=CLH^{\frac{3}{2}}\\ C&=\frac{2}{3}\sqrt{2g}\,M=5.35\,M\\ M&=1-\left(\frac{0.04\,[34.6+H]}{4}\right). \end{aligned}\right\} \quad . \quad . \quad . \quad . \quad . \quad (16)$$

where

Reducing,

$$\left.\begin{aligned} M&=0.654\ -0.01\,H\\ C&=3.4989-0.0535\,H \end{aligned}\right\} \quad . \quad . \quad . \quad . \quad . \quad (17)$$

This formula applies to a suppressed weir. Method of correction for velocity of approach is not stated. Coefficient M has a maximum value 0.654, and decreases slowly as the head increases. Limits of applicability of formula are not stated. Values of C are given below:

Coefficient C for thin-edged weirs, East Indian engineers' formula.[c]

H in feet.	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	3.499	3.494	3.488	3.483	3.478	3.472	3.467	3.462	3.456	3.451
1	3.445	3.440	3.435	3.429	3.424	3.419	3.413	3.408	3.403	3.397
2	3.392	3.386	3.381	3.376	3.370	3.365	3.360	3.354	3.349	3.344
3	3.338	3.333	3.328	3.322	3.317	3.312	3.306	3.301	3.296	3.290
4	3.285	3.280	3.274	3.269	3.264	3.258	3.253	3.248	3.242	3.237
5	3.221	3.226	3.221	3.215	3.210	3.205	3.199	3.194	3.189	3.183
6	3.178	3.172	3.167	3.162	3.156	3.151	3.146	3.140	3.135	3.130
7	3.124	3.119	3.114	3.108	3.103	3.098	3.092	3.087	3.082	3.076
8	3.071	3.066	3.060	3.055	3.050	3.044	3.039	3.034	3.028	3.023
9	3.017	3.012	3.007	3.001	2.996	2.991	2.985	2.980	2.975	2.969

[a] Hydraulics, pp. 133-135.

[b] Given in J. Mullins's Irrigation Manual, introduced in United States by G. W. Rafter and used in region of upper Hudson River. Not given in Bellasis's recent East Indian work on hydraulics.

[c] For East Indian engineers' broad-crested weir formula, using coefficients derived from the above, see p. 114.

EXPERIMENTS AND FORMULA OF JAMES B. FRANCIS.

The experiments on discharge over thin-edged weirs,[a] upon which the Francis formula is based, were made in October and November, 1852, at the lower locks of the Pawtucket canal, leading from Concord River past the Lowell dam to slack water of Merrimac River. Additional experiments were made by Francis in 1848[b] at the center vent water wheel at the Boott Cotton Mills in Lowell, with gates blocked open and with constant head. A uniform but unknown volume of water was thus passed through the turbine and over a weir having various numbers of end contractions, the effect of which was thus determined. Similar experiments were made in 1851 at the Tremont turbine,[c] where a constant volume of water was passed over weirs of lengths ranging from 3.5 to 16.98 feet and with from two to eight end contractions. These experiments were made to determine the exponent n in the weir formula

$$Q = CLH^n.$$

Francis here found $n=1.47$, but adopted the value $n=1.5=3/2$, in the experiments of 1852.

The Pawtucket canal lock was not in use at the time of the Lowell experiments in 1852 and the miter gates at the upper lock chamber were removed and the weir was erected in the lower hollow quoin of the gate chamber. The middle gates at the foot of the upper chamber were replaced by a bulkhead having a sluice for drawing off the water. A timber flume in the lower chamber of the lock was used as a measuring basin to determine the flow over the weir. Its length was 102 feet and its width about 11.6 feet. A swinging apron gate was so arranged over the crest of the weir that, when opened, the water flowed freely into the measuring basin below, and when closed, with its upper edge against the weir, the overflow passed into a wooden diverting channel, placed across the top of the lock chamber, and flowed into Concord River. An electric sounder was attached to the gate framework, by which a signal was given when the edge of the swinging gate was at the center of the nappe, when either opening or closing. By this means the time of starting and stopping of each experimental period was observed on a marine chronometer. The depth on the weir was observed by hook gages. The readings were taken in wooden stilling boxes, 11 by 18 inches square, open at the top, and having a 1-inch round hole through the bottom, which was about 4 inches below the weir crest. The weir was in the lower quoin of the gate recess, and the hook gage boxes were in the upper quoin, projecting slightly beyond the main lock walls. In weirs with end

[a] Francis, J. B., Lowell Hydraulic Experiments, pp. 103-135. [b] Idem, pp. 96-102. [c] Idem, pp. 76-95.

contractions the full width of the channel was used. For suppressed weirs, a leading channel having a width equal to the length of the weir crest was formed by constructing vertical timber walls within the main canal, extending 20 feet upstream from the weir and having their upper ends flaring about 1 foot toward the canal walls. Water was freely admitted on both sides of these timber walls. The hook gage boxes were outside of this channel. The holes in the bottom were plugged, and flush piezometer pipes were used to connect the hook-gage boxes with the inner face of the side walls of the channel of approach. Observations of the head by hook gage were taken at intervals of about 15 seconds. Each experimental period covered from 190 to 900 seconds. The hook-gage readings were reduced to weir crest level as a datum and arranged in groups of two or three, which agreed closely. The mean head was determined by the correction formula (48). In one period, 18 observations of heads ranged from 0.6310 to 0.6605 foot; their arithmetical mean was 0.6428; the computed correction was minus 0.0008.

The measured head was corrected for velocity of approach by using the theoretical formula given below. The range and character of the experiments, together with the general results, are shown in the following table:

Thin-edged weir experiments of J. B. Francis at the lower locks, Lowell, Mass., 1852.

Serial numbers of experiments.		Total number.	Width of channel at upstream side of weir	Depth of channel below top of weir at hook gage boxes.	Range of observed head, in feet.		Range of velocity of approach, in feet per second.		Length of weir crest in feet.	Number end contractions.	Approximate mean corrected head H, in feet.	Discharge coefficient C.		
From—	To—				From—	To—	From—	To—				Maximum.	Minimum.	Mean.
1	4	4	13.96	5.048	1.52430	1.56910	0.7682	0.7889	9.997	2	1.56	3.3318	3.3002	3.3181
5	10	6	13.96	5.048	1.23690	1.25490	.5904	.6000	9.997	2	1.25	3.3412	3.3159	3.3338
11	33	23	13.96	5.048	.91570	1.06920	.3951	.4863	9.997	2	1.00	3.3383	3.3110	3.3223
34	35	2	13.96	5.048	1.01025	1.02625	.3527	.3596	7.997	4	1.02	3.3617	3.3586	3.3601
36	43	8	13.96	2.014	1.02805	1.07945	.9496	1.0049	9.997	2	1.06	3.3567	3.3498	3.3527
44	50	7	9.992	5.048	.97450	.98675	.5376	.5455	9.995	0	0.98	3.3437	3.3366	3.3409
51	55	5	9.992	5.048	.99240	1.00600	.5477	.5589	9.995	0	1.00	3.3349	3.3243	3.3270
56	61	6	13.96	5.048	.77690	.81860	.3170	.3405	9.997	2	0.80	3.3287	3.3188	3.3246
62	66	5	13.96	2.014	.77115	.88865	.6694	.7963	9.997	2	0.83	3.3435	3.3376	3.3403
67	71	5	9.992	5.048	.7362	.81495	.3659	.4213	9.995	0	0.80	3.3424	3.3341	3.3393
72	78	7	13.96	5.048	.59190	.65525	.2182	.2509	9.997	2	0.62	3.3306	3.3237	3.3275
79	84	6	13.96	2.014	.63135	.68985	.5193	.5496	9.997	2	0.65	3.3278	3.3244	3.3262
85	88	4	13.96	2.014	.66940	.68815	.4382	.4526	7.997	4	0.68	3.3382	3.3333	3.3368

From a discussion of these experiments Francis presents the final formula—

$$Q=3.33LH^{\frac{3}{2}}.$$

If there are end contractions,

$$L=L'-0.1NH.$$

If there is velocity of approach,

$$H^{\frac{3}{2}}=\left[(D+h)^{\frac{3}{2}}-h^{\frac{3}{2}}\right]. \qquad . \quad . \quad (18)$$

The mean velocity v was determined by successive approximations; h was determined by the usual formula—

$$h=\frac{v^2}{2g}$$

The Francis formula for velocity of approach correction is cumbersome, and several substitutes have been devised, some of which are described in the following paragraphs.

(1) Determine the approximate velocity of approach v_1 by a single trial computation of Q, using $D=H$.

Then use

$$H=D+\frac{v_1}{2g}=D+h$$

to determine the final value of Q. For a given value of v this gives too large a value of H, but the approximate value of v_1 is somewhat too small, partially counterbalancing the error and usually giving a final value of Q sufficiently precise.

(2) By developing into series and omitting the powers h D above the first, h being always relatively small, the following closely approximate equivalent of the Francis correction formula, given by Emerson,[a] is obtained:

$$H=D+h-\frac{2}{3}\sqrt{\frac{h^3}{D}} \qquad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (19)$$

(3) Hunking and Hart[b] derive from the Francis correction formula the following equivalent expression:

$$KD^{\frac{3}{2}}=H^{\frac{3}{2}}=(D+h)^{\frac{3}{2}}-h^{\frac{3}{2}} \qquad . \quad . \quad . \quad . \quad . \quad . \quad (20)$$

$$K=\left[1+\frac{C^2}{2g}\left(\frac{D}{G}\right)^2K^2\right]^{\frac{3}{2}}-\left[\frac{C^2}{2g}\left(\frac{D}{G}\right)^2K^2\right]^{\frac{3}{2}} \qquad . \quad . \quad (21)$$

where G is the area of channel section in which D is measured, per unit length of crest.

[a] Hydrodynamics, p. 286. [b] Jour. Franklin Inst., Phila., August, 1884, pp. 121-126.

For a suppressed weir,

$$G=P+D.$$

For a contracted weir,

$$G=\frac{A}{L-0.1ND.} \quad \ldots\ldots\ldots \text{(2}$$

Hunking and Hart have computed values of K by the solution c the above formula for each 0.005 increment in D G to 0.36. Th results extended by formula (23) are given below.

Velocity of approach correction, factor K, Hunking and Hart formula, $H^{\frac{3}{2}}=KD^{\frac{3}{2}}$.

D/G	0.0	0.1	0.2	0.3	0.4	0.5	0.6
.000	1.00000	1.002528	1.009980	1.022359	1.039840	1.062250	1.089864
.005	1.000006	1.002785	1.010480	1.023110	1.040836	1.063495	1.091134
.010	1.000026	1.003053	1.010991	1.023875	1.041832	1.064740	1.092628
.015	1.000058	1.003335	1.011519	1.024653	1.042828	1.065985	1.094122
.020	1.000103	1.003628	1.012057	1.025444	1.043824	1.067230	1.095616
.025	1.000161	1.003933	1.012607	1.026248	1.045069	1.068724	1.097359
.030	1.000231	1.004251	1.013169	1.027065	1.046065	1.069969	1.098853
.035	1.000314	1.004581	1.013744	1.027895	1.047061	1.071214	1.100347
.040	1.000409	1.004923	1.014331	1.028739	1.048306	1.072708	1.102090
.045	1.000518	1.005278	1.014931	1.029596	1.049302	1.073953	1.103584
.050	1.000638	1.005644	1.015543	1.030467	1.050298	1.075198	1.105078
.055	1.000772	1.006023	1.016167	1.031350	1.051543	1.076692	1.106821
.060	1.000917	1.006414	1.016805	1.032248	1.052788	1.078186	1.108564
.065	1.001075	1.006817	1.017455	1.033117	1.053784	1.079431	1.110058
.070	1.001246	1.007232	1.018107	1.034113	1.055029	1.080925	1.111801
.075	1.001429	1.007659	1.018792	1.035109	1.056274	1.082419	1.113544
.080	1.001624	1.008099	1.019480	1.035856	1.057270	1.083664	1.115038
.085	1.001832	1.008551	1.020180	1.036852	1.058515	1.085158	1.116781
.090	1.002051	1.009015	1.020893	1.037848	1.059760	1.086652	1.118524
.095	1.002284	1.009491	1.021620	1.038844	1.061005	1.088146	1.120267

The general formula for K is too complex for common use. T expressions

$$K=1+0.2489\left(\frac{D}{G}\right)^2 \quad \ldots\ldots\ldots \text{(2-}$$

and

$$K=1+\left(\frac{D}{2G}\right)^2 \quad \ldots\ldots\ldots \text{(24}$$

are stated to give results correct within one-hundredth and one-fiftiet of 1 per cent, respectively, for values of K less than 0.36.

EXPERIMENTS AND FORMULAS OF FTELEY AND STEARNS.

The first series of experiments by Fteley and Stearns on thin-edge weir discharge[a] were made in March and April, 1877, on a suppresse weir, with crest 5 feet in length, erected in Sudbury conduit belov Farm Pond, Metropolitan waterworks of Boston.

Water from Farm Pond was let into the leading channel throug

[a] Fteley, A., and Stearns, F. P., Experiments on the flow of water, etc.: Trans. Am. Soc. C. E vol. 12, Jan., Feb., Mar., 1883, pp. 1-118.

head-gates until the desired level for the experiment, as found by previous trial, was reached. A swinging gate was then raised from the crest of the weir and the water was allowed to flow over. The maintenance of a uniform regimen was facilitated by the large area and the consequent small variation of level in Farm Pond, so that the outflow from the gates was sensibly proportional to the height they were raised. The water flowed from the weir into the conduit channel below, and was measured volumetrically. For the smaller heads the length of the measuring basin was 22 feet, and for the larger heads 367 feet.

The crest depth was observed by hook gage in a pail below the weir, connected to the channel of approach by a rubber tube entering the top of the side wall, 6 feet upstream from the weir crest. Hook-gage readings of head were taken every half minute until uniform regimen was established, and every minute thereafter. The depths in the measuring basin were also taken by hook gage. The bottom of the conduit was concave, and was graded to a slope of 1 foot per mile. It was covered with water previous to each experiment, leaving a nearly rectangular section.

The experiments in 1877 included 31 depths on a suppressed weir of 5 feet crest length, 3.17 feet high. The observed heads varied from 0.0735 to 0.8198 foot.

In 1879 a suppressed weir, with a crest length of 19 feet, was erected in Farm Pond Gate House. Head-gates and screens were close to weir; otherwise the apparatus for measuring head and starting and stopping flow was similar to that used in previous experiments. The crest of the weir was an iron bar 3¼ inches wide and one-fourth inch thick, planed and filed and attached to the upper weir timber with screws. No variation in level of the weir crest occurred. As in the preceding experiments, no by-pass was provided, and the entire overflow enter[illegible] Sudbury conduit below the weir. The conduit was partly f[illegible] water at th[illegible] leaving a nearly rectangular section, 1[illegible] in length[illegible] 9 feet wide. A difference of 3 feet [illegible] was util[illegible] suring discharge, the total capacity [illegible] cubic [illegible] were provided to reduce [illegible] covering a considerable [illegible] true water level. This [illegible] suppressed weir 19 feet [illegible] varying from 0.4685 to [illegible] from 0.151 to 0.840 foot [illegible] feet in length, respectively, [illegible] ments of James B. Francis [illegible] rmula

[illegible] 25

In the above, if there is velocity of approach,

$H=D+\alpha h$.

$\alpha=1.5$ for suppressed weirs.

$\alpha=2.05$ for weirs with end contractions.

The value of the velocity head coefficient α was determined from 94 additional experiments on the 5-foot weir in 1878. These involved measured heads ranging from 0.1884 to 0.9443 foot, heights of weir ranging from 0.50 to 3.47 feet, and velocities of approach reaching a maximum of 2.35 feet per second. Also 17 experiments were made on weirs 3, 3.3, and 4 feet long respectively; the first with two and the last two with one end contraction. These experiments included measured heads varying from 0.5574 to 0.8702 foot, and velocities of approach from 0.23 to 1.239 feet per second.

In all experiments on velocity of approach, the head was measured 6 feet upstream from crest. The width of channel was 5 feet.[a]

Fteley and Stearns found the following values of α for suppressed weirs:

Fteley and Stearns's value of α for suppressed weirs.

Measured depth on weir, in feet.	Depth of channel of approach below weir crest, in feet.			
	0.50	1.00	1.70	2.60 [b]
0.2	1.70	1.87	1.66	1.51
.3	1.53	1.83	1.65	1.50
.4	1.53	1.79	1.63	1.49
.5	1.53	1.75	1.62	1.48
.6	1.52	1.71	1.60	1.47
.7	1.51	1.68	1.59	1.46
.8	[c] 1.50	[c] 1.65	1.57	1.45
.9	1.49	1.63	1.56	[c] 1.44
1.0	1.48	1.61	1.54	1.43
1.1	.....	1.59	1.53	1.42
1.2	.....	1.57	1.51	1.41
1.3	.....	1.55	1.49	1.40
1.4	.....	1.54	1.48	1.39
1.5	.....	1.52	1.46	1.38
1.6	.....	1.51	1.44	1.37
1.7	.....	1.49	1.43	1.36
1.8	.....	.....	1.41	1.35
1.9	.....	.....	1.40	1.34
2.0	.....	.....	1.38	1.33

[a] Fteley and Stearns, idem, pp 5-23.

[b] Applicable to greater heights of weir.

[c] Limit of experiments.

Current-meter measurements showed a nearly uniform distribution of velocities in the channel of approach above the 19-foot weir, a fact to be taken account of when the formulas are applied to cases where the velocity of approach varies in different portions of the leading channel.

If there are end contractions, the net length of weir should be determined by the Francis formula,

$$L = L' - 0.1NH.$$

The head should be measured at the surface of the channel of approach, 6 feet upstream from the weir crest.

BAZIN'S EXPERIMENTS.

Bazin's experiments on thin-edged weirs were performed in the side channel of the Canal de Bourgogne, near Dijon, France, and were begun in 1886. Their results were published in Annales des Ponts et Chaussées and have been translated by Marichal and Trautwine.[a]

The standard weir consisted of horizontal timbers 4 inches square, with an iron crest plate 0.276 inch in thickness. Air chambers were placed at the ends of the weir on the downstream side, to insure full aeration of the nappe. End contractions were suppressed. The height of the first weir was 3.27 feet above channel bottom, and the head was measured in "Bazin pits," one at each side of the channel 16.40 feet upstream from the weir crest. The pit consisted of a lateral chamber in the cement masonry forming the walls of the canal. The chamber was square, 1.64 feet on each side, and communicated with the channel of approach by a circular opening 4 inches in diameter, placed at the bottom of the side wall and having its mouth exactly flush with the face of the wall. The oscillations of the water surface in the lateral chamber were thus rendered much less prominent than in the channel of approach. The water level in the Bazin pit was observed by dial indicators attached to floats, the index magnifying the variations in water level four times, the datum for the indicators having been previously determined by means of hook gages placed above the crest of the weir and by needle-pointed slide gages in the leading channel.

A drop gate was constructed on the crest of the weir to shut off the discharge at will. In each experiment the head-gates through which the water entered the leading channel were first raised and the water was allowed to assume the desired level. The weir gate was then raised, and the head-gates were manipulated to maintain a nearly con-

[a] Bazin, H., Recent experiments on flow of water over weirs, translated from the French by Marichal and Trautwine: Proc. Engineers' Club Phila., vol. 7, Jan., 1890, pp. 259–310; vol. 9, pp. 231–244, 287–319; vol. 10, pp. 121–164.

stant inflow. The arithmetical mean of the observations during (period of uniform regimen was used as the measured head for experiment.

The overflow passed into a measuring channel, 656.17 feet in len whose walls were made of smooth Portland cement concrete. channel was 6.56 feet wide, its side walls were 3.937 feet high, anc lower end was closed by water-tight masonry. Its bottom was gra to a slope of about 1:1,000. The volume of inflow was determinec first covering the channel bottom with water, then noting the cha of level during each experimental period, the capacity of the cha at various heights having previously been carefully determined. slight filtration occurred, necessitating a correction of about one-eig of 1 per cent of the total volume. The observations for each regi were continued through a period of 12 to 30 minutes.

Sixty-seven experiments were made on a weir 3.72 feet high, inc ing heads from the least up to 1.017 feet. Above this point volumetric measuring channel filled so quickly as to require the us a shorter weir. Thirty-eight experiments were made with a stanc weir, 3.28 feet long and 3.72 feet high, with heads varying from least up to 1.34 feet. For heads exceeding 1.34 feet it was neces to reduce the height of the weir in order that the depth above the v should not exceed that of the channel of approach. Forty-e experiments were made on a weir 1.64 feet long and 3.297 feet h with heads ranging from the least up to 1.780 feet. These experim sufficed to calibrate the standard weir with a degree of accuracy st by Bazin as less than 1 per cent of error.

In order to determine the effect of varying velocities of appr the following additional series of experiments were made on pressed weirs 2 meters (6.56 feet) in length.

Experiments on suppressed weirs 2 meters in length.

Number of experiments.	Range of head in feet.		Height of experimental weir, in feet.
	From—	To—	
28+30	0.489	1.443	2.46
29+29	.314	1.407	1.64
27+41	.298	1.338	1.15
44	.296	1.338	0.79

The standard weir was 3.72 feet high, and the experimental we were placed 46 to 199 meters downstream. The discharge was measured volumetrically. A uniform regimen of flow was establis and the depths on the two weirs were simultaneously observed dur each period of flow.

These experiments afforded data for the determination of the relative effect of different velocities of approach, corresponding to the different depths of the leading channel.

From these experiments Bazin deduces coefficients for a thin-edged weir 3.72 feet high, for heads up to 1.97 feet, stated to give the true discharge within 1 per cent.[a]

BAZIN'S FORMULAS FOR THIN-EDGED WEIRS.

Starting with the theoretical formula for a weir without velocity of approach, in the form

$$Q = \mu L H \sqrt{2gH}$$

and substituting

$$D + \alpha \frac{v^2}{2g}$$

for H, in the case of a weir having velocity of approach, there results,

$$Q = \mu L \left(D + \alpha \frac{v^2}{2g} \right) \sqrt{2g} \left(D + \alpha \frac{v^2}{2g} \right).$$

Bazin obtained, by mathematical transformation, the equivalent[b]

$$Q = \mu L D \sqrt{2gD} \left(1 + \alpha \frac{v^2}{2gD} \right)^{\frac{3}{2}},$$

or

$$Q = \mu \left(1 + \alpha \frac{v^2}{2gD} \right)^{\frac{3}{2}} L D \sqrt{2gD}.$$

Bazin writes

$$m = \mu \left(1 + \alpha \frac{v^2}{2gD} \right)^{\frac{3}{2}} \quad \ldots \ldots \quad (26)$$

for which equation he obtains, by mathematical transformation, the approximate equivalent[c]

$$m = \mu \left(1 + \frac{3}{2} \alpha \frac{v^2}{2gD} \right) \quad \ldots \ldots \quad (27)$$

The calculation of the factor v appearing in this formula requires the discharge Q to be known.

Assuming that the channel of approach has a constant depth P below the crest of the weir, and that its width is equal to the length of the

[a] Bazin, H., Expériences nouvelles sur l'écoulement en déversoir: Ann. Ponts et Chaussées, Mém. et Doc., 1898, 2me trimestre. See translation by Marichal and Trautwine in Proc. Eng. Club Phila., vol. 7, pp. 259-310; vol. 9, pp. 231-244.

[b] The steps in the derivation of this formula are given by Trautwine and Marichal in their translation of Bazin's report of his experiments, in Proc. Eng. Club Phila., vol. 7, p. 280.

[c] The steps in detail are given by Trautwine and Marichal in their translation of Bazin, in Proc. Eng. Club Phila., vol. 7, No. 5, p. 281.

weir, v may be expressed in terms of these factors, and of the discharge ($Q=mLD\sqrt{2gD}$).

$$v=\frac{Q}{L(P+D)}.$$

Using this value of v, Bazin obtains the expression

$$m=\mu\left[1+\omega\left(\frac{D}{D+P}\right)^2\right]. \quad . \quad . \quad . \quad . \quad . \quad . \quad (29)$$

where $\omega=\frac{3}{2}\alpha m^2$. ω is a nearly constant factor, varying only with m^2. The value of ω as well as that of α can be determined by comparative experiments on thin-edged weirs of different heights.[a]

From a discussion of his own experiments and those of Fteley and Stearns, Bazin finally obtained the formulas

$$\left.\begin{aligned} &Q=\mu LH\sqrt{2gH}, \text{ no velocity of approach;}\\ &Q=mLD\sqrt{2gD}, \text{ with velocity of approach.}\end{aligned}\right\} \quad . \quad . \quad (29)$$

$$\mu=0.405+\frac{0.003\times 3.281}{D}=0.405+\frac{0.00984}{D}[b] \quad . \quad . \quad . \quad (30)$$

For a weir with velocity of approach $\alpha=\frac{5}{3}$ and $\omega=0.55$. Substituting in equations (27) and (28),

$$m=\mu\left(1+\frac{3}{2}\cdot\frac{5}{3}\cdot\frac{v^2}{2gD}\right)=\mu\left(1+2.5\frac{v^2}{2gD}\right). \quad . \quad . \quad (31)$$

$$m=\mu\left[1+0.55\left(\frac{D}{P+D}\right)^2\right] \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (32)$$

These formulas give values of m agreeing with the results of the experiments within 1 per cent for weirs exceeding about 1 foot in height within the experimental range of head.

Approximately, for heads from 4 inches to 1 foot,

$$m=0.425+0.21\left(\frac{D}{P+D}\right)^2. \quad . \quad . \quad . \quad . \quad . \quad . \quad (33)$$

correct within 2 to 3 per cent.

The following table gives Bazin's experimental coefficients, the head and height of weir (originally meters) having been reduced to feet:

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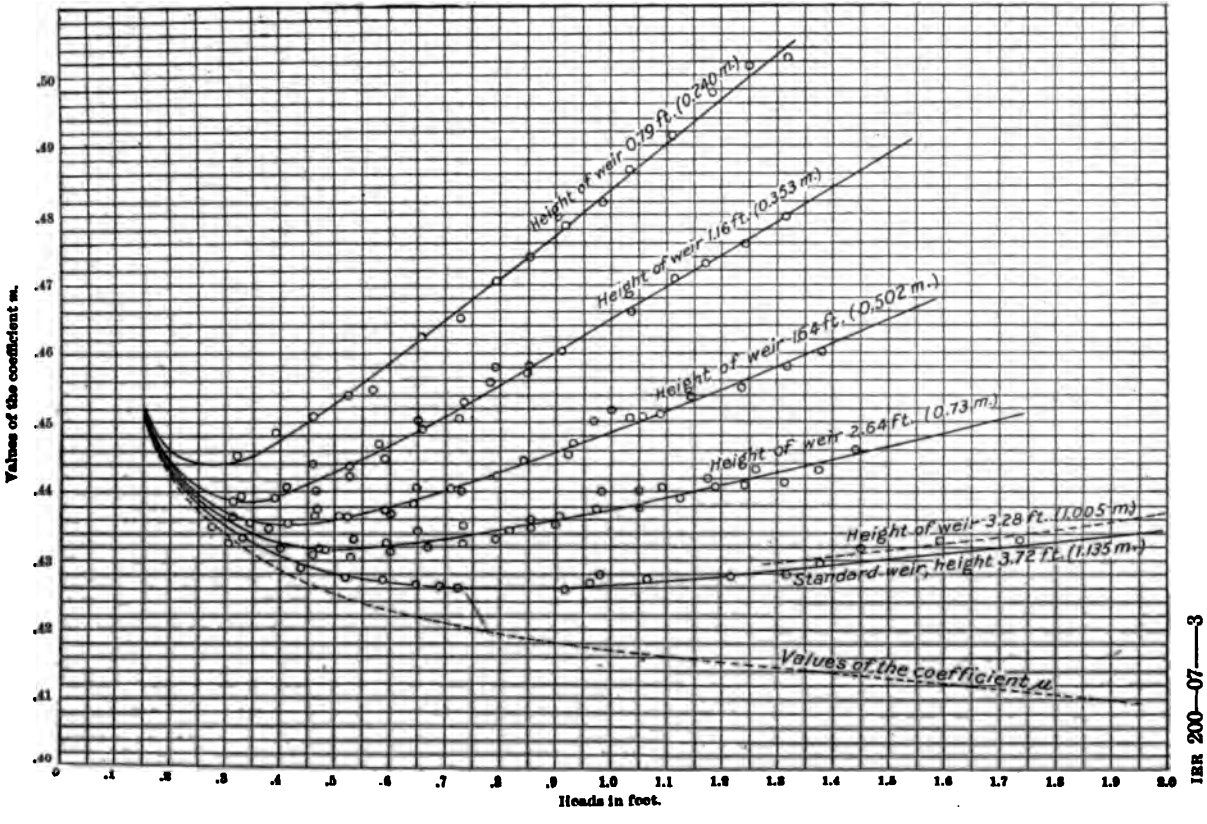
[a] For detailed analysis see Trautwine and Marichal, Proc. Eng. Club Phila., vol. 7, pp. 282-283.

[b] Experimental tabular values of μ differing very slightly from the formula within the range of Bazin's experiments are also given.


Height of weir 0.19 ft. (0.240 m.)
Height of weir 1.16 ft. (0.353 m.)
Height of weir 1.64 ft. (0.502 m.)
Height of weir 2.64 ft. (0.73 m.)
Height of weir 3.28 ft. (1.005 m.)
Standard weir, height 3.72 ft. (1.135 m.)
Values of the coefficient u
Values of the coefficient m.
Heads in feet.
.50
.49
.48
.47
.46
.45
.44
.43
.42
.41
.40
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0

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Values of the Bazin coefficient C in the formula $Q=CLH^{\frac{3}{2}}$ for a thin-edged weir, without end contraction.

Measured head *D*.	Height of crest of weir above bed of channel of approach, in feet.										Measured head *D*.
	0.66	0.98	1.31	1.64	1.97	2.62	3.28	4.92	6.56	∞	
Feet.	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	*C*	Meters.
0.164	3.673	3.633	3.617	3.609	3.601	3.601	3.601	3.593	3.593	3.594	0.05
.197	3.657	3.609	3.585	3.569	3.569	3.561	3.553	3.553	3.553	3.550	.06
.230	3.649	3.593	3.569	3.553	3.545	3.537	3.529	3.529	3.521	3.522	.07
.262	3.657	3.585	3.553	3.537	3.529	3.513	3.513	3.505	3.505	3.499	.08
.295	3.665	3.585	3.545	3.529	3.513	3.497	3.497	3.489	3.481	3.481	.09
.328	3.681	3.585	3.545	3.521	3.505	3.489	3.481	3.473	3.473	3.466	.10
.394	3.705	3.593	3.545	3.513	3.497	3.473	3.465	3.449	3.449	3.441	.12
.459	3.737	3.609	3.553	3.513	3.489	3.465	3.449	3.432	3.432	3.422	.14
.525	3.777	3.633	3.561	3.513	3.489	3.457	3.440	3.424	3.416	3.405	.16
.591	3.810	3.657	3.569	3.521	3.489	3.457	3.432	3.416	3.408	3.392	.18
.656	3.850	3.681	3.585	3.529	3.497	3.457	3.432	3.408	3.392	3.380	.20
.722	3.882	3.705	3.601	3.545	3.505	3.457	3.432	3.400	3.392	3.371	.22
.787	3.914	3.729	3.625	3.561	3.513	3.465	3.432	3.400	3.384	3.364	.24
.853	3.946	3.753	3.649	3.577	3.529	3.465	3.440	3.400	3.384	3.358	.26
.919	3.978	3.785	3.665	3.593	3.537	3.473	3.440	3.400	3.384	3.353	.28
.984	4.010	3.810	3.689	3.609	3.553	3.481	3.449	3.400	3.376	3.348	.30
1.050	.....	3.834	3.705	3.625	3.561	3.497	3.449	3.400	3.376	3.343	.32
1.116	.....	3.858	3.721	3.641	3.577	3.505	3.457	3.400	3.376	3.338	.34
1.181	.....	3.874	3.745	3.657	3.593	3.513	3.465	3.400	3.376	3.333	.36
1.247	.....	3.898	3.761	3.673	3.601	3.521	3.465	3.400	3.376	3.328	.38
1.312	.....	3.922	3.785	3.681	3.617	3.529	3.473	3.400	3.376	3.323	.40
1.378	.....	3.938	3.801	3.697	3.625	3.537	3.481	3.408	3.376	3.319	.42
1.444	.....	3.962	3.818	3.713	3.641	3.545	3.489	3.408	3.376	3.316	.44
1.509	.....	3.978	3.834	3.729	3.657	3.553	3.489	3.408	3.376	3.311	.46
1.575	.....	.....	3.850	3.745	3.665	3.561	3.497	3.408	3.376	3.306	.48
1.640	.....	.....	3.866	3.753	3.681	3.569	3.505	3.416	3.376	3.303	.50
1.706	.....	.....	3.874	3.769	3.689	3.577	3.513	3.416	3.376	3.298	.52
1.772	.....	.....	3.890	3.785	3.697	3.585	3.513	3.416	3.376	3.294	.54
1.837	.....	.....	3.906	3.793	3.713	3.593	3.521	3.424	3.376	3.289	.56
1.903	.....	.....	3.922	3.810	3.721	3.601	3.529	3.424	3.376	3.285	.58
1.969	.....	.....	3.930	3.818	3.737	3.617	3.537	3.424	3.376	3.282	.60
Meters.	0.20	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	∞	.....

This table, unfortunately, is inconvenient for interpolation in English units. The values also differ slightly from those computed from the formulas. The table illustrates the difficulty of practical application of a weir formula in which the coefficient varies rapidly both with head and height of weir.

A table has been added giving values of μ computed by formul (30) for a thin-edged weir without velocity of approach.

Values of μ in the Bazin formula for weirs of infinite height, with no velocity of approacl

H. *Feet.*	0.	0.01.	0.02.	0.03.	0.04.	0.05.	0.06.	0.07.	0.08.	0.09.	0.1.
0.0	.....	1.389	0.8970	0.7331	0.6510	0.6018	0.5693	0.5457	0.5280	0.5142	0.5034
.1	0.5034	.4944	.4870	.4807	.4753	.4706	.4665	.4628	.4596	.4568	.4542
.2	.4542	.4518	.4497	.4478	.4460	.4444	.4429	.4414	.4401	.4389	.4378
.3	.4378	.4367	.4357	.4348	.4339	.4331	.4324	.4316	.4309	.4302	.4296
.4	.4296	.4290	.4284	.4278	.4273	.4268	.4264	.4260	.4255	.4251	.4247
.5	.4247	.4243	.4239	.4236	.4232	.4229	.4225	.4222	.4219	.4216	.4214
.6	.4214	.4211	.4208	.4206	.4204	.4202	.4200	.4197	.4195	.4193	.4191
.7	.4191	.4189	.4187	.4185	.4183	.4181	.4180	.4178	.4176	.4174	.4173
.8	.4173	.4171	.4170	.4168	.4167	.4166	.4164	.4163	.4162	.4160	.4159
.9	.4159	.4158	.4157	.4156	.4154	.4153	.4152	.4151	.4150	.4149	.4148
1.0	.4148	.4147	.4146	.4146	.4145	.4144	.4143	.4142	.4141	.4140	.4139
1.1	.4139	.4139	.4138	.4137	.4136	.4136	.4135	.4134	.4133	.4133	.4132
1.2	.4132	.4131	.4131	.4130	.4129	.4129	.4128	.4127	.4127	.4126	.4126
1.3	.4126	.4125	.4124	.4124	.4123	.4123	.4122	.4122	.4121	.4121	.4120
1.4	.4120	.4120	.4119	.4119	.4118	.4118	.4117	.4117	.4116	.4116	.4116
1.5	.4116	.4115	.4115	.4114	.4114	.4113	.4113	.4113	.4112	.4112	.4112
1.6	.4112	.4111	.4111	.4110	.4110	.4110	.4109	.4109	.4108	.4108	.4108
1.7	.4108	.4108	.4107	.4107	.4107	.4106	.4106	.4106	.4105	.4105	.4105
1.8	.4105	.4104	.4104	.4104	.4103	.4103	.4103	.4103	.4102	.4102	.4102
1.9	.4102	.4102	.4101	.4101	.4101	.4100	.4100	.4100	.4100	.4099	.4099
2.0	.4099	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

DERIVED FORMULAS FOR THIN-EDGED RECTANGULAR WEIRS

A number of weir formulas have been derived from subsequen analysis or recomputation of the experiments of Francis, Fteley an Stearns, and Bazin, differing more or less from those given by th experimenters.

FTELEY AND STEARNS–FRANCIS FORMULA.[a]

$$Q=3.33LH^{\frac{3}{2}}+0.007L \quad . \quad . \quad . \quad . \quad . \quad (3$$

Correction for end contractions is to be made by the Franc formula; velocity of approach correction by the Fteley and Stear formulas

$H=D+1.5h$, for suppressed weir.
$H=D+2.05h$, for contracted weir.

HAMILTON SMITH'S FORMULA.[b]

The base formula adopted is

$$Q=\frac{2}{3}MLH\sqrt{2gH} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (35)$$

[a] *Fteley and Stearns*, Experiments on the flow of water, etc.: Trans. Am. Soc. C. E., vol. 12, p. 82.
[b] *Smith, Hamilton*, Hydraulics, pp. 123–132.

The velocity of approach correction is made by the use of the formulas

$$H=D+1.4h, \quad \text{for contracted weirs.}^a$$
$$H=D+1\tfrac{1}{2}h, \quad \text{for suppressed weirs.}$$

A diagram and tables of values of the coefficient M are given by the author. The correction for partial or complete contraction is included in the coefficient, separate values of M being given for suppressed and contracted weirs.

Making $C=\frac{2}{3}M\sqrt{2g}$, the Smith formula (35) may be written

$$Q=CLH^{\frac{3}{2}},$$

which is directly comparable with the Francis formula.

Smith's coefficients in the above form are given in the following tables.

Hamilton Smith's coefficients for weirs with contraction suppressed at both ends, for use in the formula $Q=CLH^{\frac{3}{2}}$.

H= Head, in feet.	L'=length of weir, in feet.								
	19	15	10	7	5	4	3[a]	2[a]	0.66[b]
0.1	3.515	3.515	3.520	3.520	3.526	.....	.....	.....	3.611
.15	3.440	3.445	3.445	3.451	3.451	3.461	3.472	3.488	3.542
.2	3.397	3.403	3.408	3.408	3.413	3.429	3.435	3.450	3.510
.25	3.371	3.376	3.381	3.386	3.392	3.403	3.413	3.429	3.494
.3	3.349	3.354	3.360	3.365	3.376	3.386	3.403	3.418	3.483
.4	3.322	3.328	3.333	3.344	3.360	3.371	3.386	3.403	3.478
.5	3.312	3.317	3.322	3.338	3.354	3.371	3.386	3.408	3.478
.6	3.306	3.312	3.317	3.333	3.354	3.371	3.392	3.413	3.483
.7	3.306	3.312	3.317	3.338	3.360	3.376	3.397	3.424	3.494
.8	3.306	3.317	3.322	3.344	3.365	3.386	3.408	3.441	3.510
.9	3.312	3.317	3.328	3.354	3.376	3.397	3.418	3.451	.....
1.0	3.312	3.322	3.338	3.360	3.386	3.408	3.429	3.467	.....
1.1	3.317	3.328	3.344	3.371	3.397	3.419	3.445	.....	.....
1.2	3.317	3.333	3.349	3.381	3.403	3.429	3.456	.....	.....
1.3	3.322	3.338	3.360	3.386	3.413	3.440	3.467	.....	.....
1.4	3.328	3.344	3.365	3.392	3.424	3.445	.....	.....	.....
1.5	3.328	3.344	3.371	3.403	3.429	3.456	.....	.....	.....
1.6	3.333	3.349	3.376	3.408	3.435	3.461	.....	.....	.....
1.7	3.333	3.349	3.381	3.413	.....	.....	.....	.....	.....
2.0	.....	.....	.....	.....	.....	.....	.....	.....	.....

[a] The use of the head corresponding to central surface velocity without correction, to determine D, is also recommended.

[b] Approximate.

Hamilton Smith's coefficients for weirs with two complete end contractions, for use in the formula $Q = CLH^{\frac{3}{2}}$.

H= Head.	*L'*=length of weir, in feet.										
	0.66	1 [a]	2	2.6	3	4	5	7	10	15	19
0.1	3.381	3.419	3.456	3.478	3.488	3.494	3.494	3.499	3.504	3.504	3.510
.15	3.312	3.344	3.392	3.408	3.413	3.419	3.424	3.424	3.429	3.435	3.435
.2	3.269	3.306	3.349	3.365	3.371	3.376	3.376	3.381	3.386	3.392	3.392
.25	3.237	3.274	3.322	3.333	3.338	3.344	3.349	3.354	3.360	3.360	3.365
.3	3.215	3.253	3.296	3.306	3.312	3.322	3.322	3.333	3.338	3.338	3.344
.4	3.183	3.215	3.258	3.274	3.280	3.285	3.290	3.301	3.306	3.312	3.317
.5	3.156	3.189	3.237	3.247	3.253	3.264	3.269	3.280	3.290	3.295	3.301
.6	3.140	3.172	3.215	3.231	3.237	3.247	3.253	3.269	3.280	3.285	3.290
.7	3.130	3.156	3.199	3.210	3.226	3.231	3.242	3.258	3.274	3.280	3.285
.8	.....	.....	3.183	3.199	3.215	3.221	3.231	3.247	3.269	3.274	3.280
.9	.....	.....	3.167	3.189	3.199	3.210	3.226	3.242	3.258	3.269	3.274
1.0	.....	.....	3.156	3.172	3.189	3.199	3.215	3.231	3.253	3.264	3.269
1.1	.....	.....	3.140	3.162	3.172	3.189	3.205	3.226	3.242	3.258	3.264
1.2	.....	.....	3.130	3.151	3.162	3.178	3.194	3.215	3.237	3.253	3.264
1.3	.....	.....	3.114	3.135	3.151	3.167	3.199	3.205	3.231	3.247	3.258
1.4	.....	.....	3.103	3.124	3.140	3.156	3.178	3.199	3.221	3.242	3.258
1.5	.....	.....	.....	3.114	3.130	3.151	3.167	3.189	3.215	3.237	3.253
1.6	.....	.....	.....	3.103	3.114	3.140	3.162	3.183	3.210	3.231	3.247
1.7	.....	.....	.....	.....	.....	.....	.....	3.178	3.205	3.226	3.247
2.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

[a] Approximate.

Hamilton Smith's coefficient C for long weirs.

H	0.1	0.2	0.3	0.4	0.5	0.6	0.7
0.00	3.5096	3.3972	3.3488	3.3170	3.3010	3.2956	3.2849
.01	3.4957	3.3908	3.3411	3.3154	3.3005	3.2945	3.2838
.02	3.4818	3.3844	3.3384	3.3138	3.2999	3.2935	3.2828
.03	3.4678	3.3780	3.3358	3.3122	3.2994	3.2924	3.2817
.04	3.4539	3.3716	3.3331	3.3106	3.2988	3.2913	3.2806
.05	3.4400	3.3652	3.3304	3.3090	3.2983	3.2902	3.2796
.06	3.4314	3.3537	3.3277	3.3074	3.2978	3.2892	3.2785
.07	3.4229	3.3512	3.3250	3.3058	3.2972	3.2881	3.2773
.08	3.4143	3.3488	3.3224	3.3042	3.2967	3.2870	3.2762
.09	3.4058	3.3463	3.3197	3.3026	3.2961	3.2860	3.2752

Hamilton Smith's formula is based on a critical discussion of the experiments of Lesbros, Poncelet and Lesbros, James B. Francis, Fteley and Stearns, and Hamilton Smith; including series with and without contractions and having crest lengths from 0.66 to 19 feet.

SMITH-FRANCIS FORMULA.

The Smith-Francis formula,[a] based on Francis's experiments, reduced to the basis of correction for contractions and velocity of approach used with Hamilton Smith's formula, is,
for a suppressed weir,

$$Q=3.29\left(L+\frac{H}{7}\right)H^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (36)$$

for weir of great length or with one contraction,

$$Q=3.29LH^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (37)$$

for weir with full contraction,

$$Q=3.29\left(L-\frac{H}{10}\right)H^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (38)$$

If there is velocity of approach,

$H=D+1.4\ h$, for a contracted weir.
$H=D+1\frac{1}{2}\ h$, for a suppressed weir.

PARMLEY'S FORMULA.[b]

Parmley's formula is

$$Q=CKLD^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (39)$$

If there are end contractions, the correction is to be made by the Francis formula,

$$L=L'-0.1NH$$

The factor K represents the correction for velocity of approach.
The factor has been derived by comparing the velocity correction factor in the Bazin formula (formula 32), written in the form

$$K=\left[1+0.55\left(\frac{a}{A}\right)^2\right],$$

with the approximate Francis correction as deduced by Hunking and Hart (formula 23), written in the form

$$K=\left[1+0.2489\left(\frac{a}{A}\right)^2\right],$$

where a is the area of the section of discharge, for either a suppressed or contracted weir, and A is the section of the leading channel. It is observed that there is an approximately constant relation between the two corrections, that of Bazin being 2.2 times that of Francis.

[a] Smith, Hamilton, Hydraulics, pp. 99 and 137.
[b] Rafter, G. W., *On the flow of water over dams*: Trans. Am. Soc. C. E., vol. XX, pp. 350-359, discussion by *Walter C. Parmley*.

Parmley adopts the Bazin correction and gives the following tabl which may also conveniently be applied in computing discharge l Bazin's formula.

The discharge coefficient C used by Parmley is that for a weir wi no velocity of approach, as in the Francis formula. It is not, ho ever, constant. Its values have been deduced from a mean curve re resenting the experiments of Francis, Fteley and Stearns, and Bazin

Velocity of approach correction, K, Parmley and Bazin formulas.

$\frac{a}{A}$	0	0.1	0.2	0.3	0.4	0.5
0.00	.....	1.0055	1.0220	1.0495	1.0880	1.1375
.01	1.0001	1.0066	1.0243	1.0529	1.0925	1.1431
.02	1.0002	1.0079	1.0266	1.0563	1.0970	1.1487
.03	1.0005	1.0093	1.0291	1.0599	1.1017	1.1545
.04	1.0009	1.0108	1.0317	1.0636	1.1065	1.1604
.05	1.0014	1.0124	1.0344	1.0674	1.1114	1.1664
.06	1.0020	1.0141	1.0372	1.0713	1.1164	1.1725
.07	1.0027	1.0159	1.0401	1.0753	1.1215	1.1787
.08	1.0035	1.0178	1.0431	1.0794	1.1267	1.1850
.09	1.0044	1.0198	1.0463	1.0837	1.1321	1.1915

Parmley's weir formula, coefficient C.

D, feet.	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
.1	3.580	3.568	3.556	3.544	3.532	3.520	3.512	3.503	3.495	3.486
.2	3.478	3.471	3.464	3.458	3.451	3.444	3.439	3.434	3.430	3.425
.3	3.420	3.416	3.412	3.408	3.404	3.400	3.397	3.394	3.391	3.388
.4	3.385	3.383	3.381	3.380	3.378	3.376	3.374	3.373	3.371	3.370
.5	3.368	3.367	3.366	3.364	3.363	3.362	3.361	3.360	3.360	3.359
.6	3.358	3.357	3.356	3.356	3.355	3.354	3.353	3.353	3.352	3.352
.7	3.351	3.351	3.350	3.350	3.349	3.349	3.348	3.348	3.347	3.347
.8	3.346	3.345	3.345	3.344	3.344	3.343	3.342	3.342	3.341	3.341
.9	3.340	3.339	3.339	3.338	3.338	3.337	3 336	3.336	3.335	3.335
1.0	3.334	3.334	3.333	3.332	3.332	3.332	3.331	3.330	3.330	3.329
1.1	3.329	3.328	3.328	3.328	3.327	3.326	3.326	3.326	3.325	3.324
1.2	3.324	3.324	3.323	3.322	3.322	3.322	3.321	3.320	3.320	3.320
1.3	3.319	3.318	3.318	3.317	3.317	3.316	3.315	3.315	3.314	3.314
1.4	3.313	3.312	3.312	3.311	3.311	3.310	3.309	3.309	3.308	3.308
1.5	3.307	3.306	3.306	3.305	3.305	3.304	3.303	3.303	3.302	3.302
1.6	3.301	3.301	3.300	3.300	3.299	3.298	3.298	3 298	3.297	3.296
1.7	3.296	3.295	3.295	3.294	3.294	3.293	3.292	3.292	3.291	3.291
1.8	3.290	3.290	3.289	3.288	3.288	3.288	3.287	3.286	3.286	3.285
1.9	3.285	3.285	3.284	3.284	3.283	3.282	3.282	3.282	3.281	3.280
2.0	3.280	.....	.....	.....	.....	.....	.....	.....	.....	.....

EXTENSION OF THE WEIR FORMULA TO HIGHER HEADS.

It will be noticed that all the accepted formulas for discharge over thin-edged rectangular weirs are based on experiments in which the head did not exceed 2 feet above crest. It is often desirable to utilize the weir for stream gagings where the head is greater, especially for the determination of maximum discharge of streams, the head frequently being as large as 6, 8, or even 10 or 12 feet.

In the experiments at Cornell University on weirs of irregular section it was often necessary to utilize depths on the standard weir exceeding the known limit of the formula. A series of experiments was accordingly carried out in which a depth on a standard thin-edged weir (16 feet long) not exceeding the limit of the formula was utilized to determine the discharge over a similar but shorter standard thin-edged weir (6.56 feet long) for depths up to approximately 5 feet.[a] The results of these experiments, as recomputed, eliminating slight errors in the original, are given below.

It will be noted that the weir was short and the velocity of approach relatively large, yet, according to the results when corrected by the Francis method, the average value of C for heads from 0.75 to 4.85 feet is 3.296, or 98.88 per cent of the Francis coefficient for a thin-edged weir. The average value of C for heads from 0.746 foot to 2 feet is 3.266, and for heads from 2 to 4.85 feet, 3.278.

United States Deep Waterways experiments at Cornell hydraulic laboratory for extension of thin-edged weir formula.

Standard weir, 16 feet long, 13.13 feet high.		Lower thin-edged weir: P=5.2, L 6.56.					Q, cubic feet per second, per foot (corrected).	$C=\frac{Q}{H^{\frac{3}{2}}}$
Cor. D, longitudinal, piezometer, centimeters.	Q, Bazin formula, in cubic feet per second.	Observed P, flush, piezometer, centimeters.	D, in feet.	$\frac{D}{P+D}$	K Hunking and Hart.	$H^{\frac{3}{2}}$		
1	2	3	4	5	6	7	8	9
12.28	14.12	22.744	0.7462	0.1255	1.0041	0.6469	2.1066	3.256
15.30	19.42	27.855	.9139	.1495	1.0056	.8787	2.9143	3.317
18.39	25.35	33.175	1.0885	.1731	1.0075	1.1434	3.8183	3.331
21.65	32.24	39.419	1.2933	.1992	1.0099	1.4849	4.8685	3.279
24.16	37.86	44.000	1.4436	.2173	1.0122	1.7564	5.7252	3.260
27.21	45.18	49.699	1.6306	.2387	1.0141	2.1116	6.8333	3.236
30.16	52.62	55.213	1.8115	.2583	1.0166	2.4787	7.9750	3.218
30.22	52.77	55.128	1.8088	.2581	1.0166	2.4730	7.9977	3.234
37.90	73.46	68.238	2.2389	.3010	1.0225	3.4254	11.1516	3.226
44.22	92.79	80.566	2.6434	.3370	1.0283	4.4193	14.0960	3.190
59.00	143.90	105.639	3.4660	.4000	1.0398	6.6095	21.8902	3.312
74.22	202.37	130.286	4.2747	.4512	1.0504	9.2867	30.8008	3.317
81.69	233.81	142.557	4.6773	.4735	1.0557	10.6789	35.5933	3.333

[a] Rafter, G. W., On the flow of water over dams: Trans. Am. Soc. C. E., vol. 44, p. 397.

If it is borne in mind that the influences which go to make up variation in the weir coefficient are more potent for low than for larger heads, it may be confidently asserted that the Francis formula is applicable within 2 per cent for heads as great as 5 feet, and by inference it is probably applicable for much greater heads as well.

COMPARISON OF WEIR FORMULAS.

The later weir formulas all give results agreeing, for the range of heads covered, within the limit of accuracy of ordinary stream measurements. Which of the several formulas to use will be determined by convenience and by the conditions attending the measurements.

The Francis formula is applicable for weirs with perfect bottom contraction and for any head above 0.50 foot.

The Hamilton Smith, Fteley and Stearns, and Bazin formulas are more accurate for very slight heads, or where bottom contraction is imperfect, this element, which tends to increase discharge, being included in the larger velocity of approach correction. These formulas are, however, based on experiments none of which exceeded 2 feet head, and they have not been extended.

For suppressed weirs in rectangular channels having conditions closely duplicating Bazin's experiments, his formula is probably most applicable. The head should preferably be measured in a Bazin pit, opening at the bottom of the channel, 16.4 feet upstream from the weir. In a suppressed weir, if the nappe is allowed to expand laterally after leaving the weir, the computed discharge by any of the formulas should be increased from one-fourth to one-half of 1 per cent.

Comparative discharge by various formulas over weirs of great height and length; no end contractions nor velocity of approach.[a]

Formula.	Coefficient C, for heads ranging from 0.20 to 4 feet.				Per cent of discharge by Francis formula for heads ranging from 0.20 to 4 feet.			
	0.20	0.50	1.00	4.00	0.20	0.50	1.00	4.00
Castel	3.4872	3.4872	3.4872	3.4872	104.616	104.616	104.616	104.616
Boileau	3.3455	3.3455	3.3455	3.3455	100.365	100.365	100.365	100.365
Weisbach	3.4025	.....	3.3136	.....	102.075	.....	99.408	.....
Francis	3.33	3.33	3.33	3.33	100.00	100.0	100.0	100.0
Fteley and Stearns	3.5004	3.3269	3.317	3.3109	105.012	99.807	99.51	99.327
Bazin	3.642684	3.406094	3.326696	3.26783	109.281	102.183	99.801	98.03
Fteley-Stearns-Francis	3.3800	3.3300	3.319	3.31375	101.400	99.90	99.570	99.41
Hamilton Smith	3.3972	3.3010	3.284	3.284	101.916	99.030	98.520	.....
Smith-Francis	3.29	3.29	3.29	3.29	98.70	98.70	98.70	.....
Parmley	3.478	3.368	3.334	.....	104.340	101.040	100.020	.....
East Indian engineers	3.488	3.472	3.445	3.285	104.640	104.16	103.35	98.55

[a] Computed by H. R. Beebe, C. E.

Table showing comparative discharge per foot of crest for suppressed weirs of various lengths, heads, and velocities of approach.[a]

Length (L)	2	2	10	10	10
Height (P)	1	2	2	4	4
Head (D)	1.0	1.0	1.0	1.0	4
Approximate velocity of approach (v)	1.90	1.18	1.16	.68	2.15
Castel	3.7822	3.6127	3.6217	3.5308	30.3037
Boileau	3.8630	3.5484	3.5484	3.4144	30.9046
Francis	3.5373	3.4218	3.4218	3.3832	28.2983
Fteley and Stearns	3.7268	3.4729	3.4730	3.3669	29.7470
Bazin	3.7845	3.3766	3.3766	3,4002	29.7555
Fteley-Stearns-Francis	3.7297	3.4752	3.4752	3.3690	29.7000
Hamilton Smith	3.9220	3.6392	3.4872	3.3878	.....
Smith-Francis	4.0581	3.7109	3.4847	3.3876	31.573
Parmley	3.7924	3.5337	3.5337	3.3347	.....
Average	3.800	3.532	3.490	3.395	30.040

[a] Computed by H. R. Beebe, C. E.

COMPARISON OF VARIOUS VELOCITY OF APPROACH CORRECTIONS.

The various modes of correction for velocity of approach used by different investigators can be rendered nearly identical in form, varying, however, in the value of the coefficient α adopted.

Comparative coefficients of correction for velocity of approach for thin-edged weirs with end contractions suppressed.

Experimenter.	Value of α in the formula $H=D+\alpha\frac{v^2}{2g}$	Values of ω in the formula $K=1+\omega\left(\frac{a}{A}\right)^2$
Boileau	$\alpha=1.8$	
Lesbros	$\alpha=1.56$	
Fteley and Stearns	$\alpha=1.5$	
Francis	[a] $\alpha=1-\frac{2}{3}\sqrt{\frac{h}{D}}$	[b] $\omega=0.2489$
Bazin	$\alpha=1.69$ or $\frac{5}{3}$	$\omega=0.55$

[a] Emerson. [b] Hunking and Hart.

The above values were all derived from experiments on thin-edged weirs. Bazin's experiments covered the larger range of velocities and were most elaborate. It may be noted that the correction applied by Bazin is two and two-tenths times that of Francis for a given velocity

of approach. Bazin's correction is, in effect, an increase in the meas ured head of 1.69 times the velocity head, while Francis increases th measured head by an amount $\frac{2}{3}\sqrt{\frac{h}{D}}$ *less than* the velocity head accord ing to Emerson's formula.

Ratio of the various corrections for velocitiy of approach for suppressed weirs.

	Bazin.	Fteley and Stearns.	Hamilton Smith.	Francis.
Bazin	1.000	1.127	1.271	2.2
Fteley and Stearns	.887	1.000	1.128	1.95
Hamilton Smith	.789	.887	1.000	1.73
Francis	.454	.511	.576	1.00

The factors in the above table are not strictly accurate, for the rea son that the expressions used to deduce the equivalents from the dif ferent formulas are in some cases approximations. They serve t illustrate the relative magnitude of the different corrections for thin edged weirs without end contractions. For thin-edged weirs with en contraction, Hamilton Smith uses the coefficient $\alpha=1.4$ and Fteley an Stearns give the coefficient $\alpha=2.05$.

There are no experiments available relative to the value of th velocity correction for other than thin-edged weirs. It is necessary therefore, to utilize the values above given for weirs of irregular sec tion. It will be seen that it matters little in what manner the correc tion for velocity of approach is applied, either by directly increasin the observed head, as in the formulas of Hamilton Smith and Ftele and Stearns, or by including the correction in the weir coefficient, a is done by Bazin, or by utilizing a special formula to derive the cor rected head, after the manner of James B. Francis. The three method can be rendered equivalent in their effect.

The important point is that the corrected result must be the same a that given by the author of the formula which is used to calculate th discharge. As to the relative value of the different modes of apply ing the correction, it may be said of that of Francis, that in its origina form it is cumbersome, but it renders the correction independent o dimensions of the leading channel, as do also the formulas for correc tion used by Hamilton Smith, and Fteley and Stearns. Inasmuch a the velocity head is a function of the discharge, successive approxima tions are necessary to obtain the final corrected head by any one o these three formulas.

By using the Hunking and Hart formula the correction for th Francis weir formula becomes fairly simple, as it does not require th *determination* of the mean velocity of approach by successive approxi

mations, but to apply this formula it is necessary to know the dimensions of the leading channel and of the weir section. The approximation given by Emerson is also much simpler than the original Francis formula.

Bazin's method of including the velocity correction in the coefficient makes the weir coefficients obtained by the experiments comparable one with another only when both the head and velocity of approach are the same in both cases.[a] His correction also involves the dimensions of the leading channel as factors. Obviously, in the case of many broad-crested weirs utilized for measuring flow, the dimensions of the leading channel can not be ascertained accurately and there is great variation of velocity in different portions of the section of approach. It becomes necessary that the correction should be in such a form that it is a function of the velocity and not of the channel dimensions.

It is to be noticed that where an attempt has been made in the weir experiments to eliminate velocity of approach effect from the coefficient the velocity has been nearly equalized by screens and has been determined by successive approximations. It is suggested that where the velocities vary widely they be determined by current meter in several subdivisions of the section, the approximate integral kinetic energy estimated, and a value of α selected depending on the ratio of $\frac{h'}{h}$ so obtained, where h is the velocity head corresponding to the mean velocity and h' is the velocity head which would result if the actual velocities were equalized. Inasmuch as the surface velocity usually exceeds the mean velocity in the channel of approach in about the same ratio that h' exceeds h, the suggestion is made by Hamilton Smith[b] that where the velocity of approach is unavoidably variable, or the boundaries of the current are uncertain, the surface velocity v_s be measured by floats and applied directly in the determination of the quantity h.

The variations in discharge over a thin-edged weir, by the different formulas, are often less than the difference in the correction for velocity of approach would indicate. In the formula of Fteley and Stearns, as compared with Francis, for example, the larger velocity correction is in part compensated by a smaller weir coefficient, and the same is true of the formulas of Hamilton Smith and Bazin for cases where the head is large.

[a] See special discussion of the point, p. 63.

[b] Smith, Hamilton, Hydraulics, p. 84.

END CONTRACTIONS—INCOMPLETE CONTRACTION.

The formula for end contractions deduced by James B. Fran very generally used. The correction is made to the length of the result obtained being the length of a suppressed weir tha give the same discharge.

$$L = L' - b\,NH \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad .$$

b = A coefficient, the value of which, deduced by Fran $b = 0.1$.

L' = Actual length of weir crest.

L = Length of equivalent suppressed weir crest.

N = Number of end contractions.

H = Effective head, feet.

The experiments of Fteley and Stearns,[a] while somewhat disco indicate an average value of b for heads from 0.3 to 1 foot, of 0.1. The value of b apparently decreases as the head increase also decreases if the end contraction piece is so near the side c channel as to render the contraction incomplete.

Hamilton Smith shows that side contractions and bottom or contraction are mutually related, and that the side width of the nel of approach should be at least twice the least dimension c weir, whether L or H. Usually L is much greater than H, an side width may be made at least as great as $2H$. The specificati Francis is, side width $\overline{>} H$. The depth (D) of the leading ch should be at least $2H$.

Smith's rule indicates that to provide complete contraction th of leading section A must bear a relation to the area of weir sec depending upon the relative head and length of crest.

For two weirs of equal section a the necessary channel-section are as follows:

$L' = 12$	$H = 1$	$a = 12$	$A = 48$
$L' = 4$	$H = 3$	$a = 12$	$A = 144$

Hamilton Smith prefers to use separate coefficients for supp weirs from those for contracted weirs, the relation between the cients being expressed by the formula

$$C_p = C_c\left(1 + z\,\frac{S}{R}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad .$$

C_p = Coefficient for partially suppressed weir, as with complete pression on sides and full contraction at bottom.

[a] Fteley and Stearns, Experiments on the flow of water, etc.: Trans. Am. Soc. C. E., vol 108-113.

C_c=Coefficient for completely contracted weir.
X=Least dimension of weir, whether L or H.
R=Wetted perimeter of weir=$L+2H$.
Y=Distance from any side of weir to the respective side of channel, where there is partial suppression.
S=Length of sides on which there is partial suppression.

Smith's values of contraction coefficient z in formula 31 are

Y/X	z
3	0.000
2	.005
1	.025
½	.06
0	.16

The ratio Y/X approximately measures the amount of contraction.[a]

Bazin does not give a formula for weirs with end contractions. The Bazin formula may be applied to weirs in which the height of weir is so small that the bottom contraction is partially suppressed. The Bazin coefficient then includes:

1. Effect of contraction from surface curve.
2. Effect of crest contraction and its modification by both velocity of approach and by partial suppression, if any.
3. Effect of velocity of approach proper.
4. Effect of distribution of velocities in channel of approach.
5. Loss of head from friction and eddies.

As the Bazin weirs were very low, and these factors go to increase the correction necessary, it will be seen that the relatively large velocity of approach correction required by Bazin's formula may be readily accounted for.

The experiments of Flinn and Dyer on the Cippoletti weir (see p. 48) indicate that the effect of end contraction may be somewhat greater than that indicated by the Francis formula. Any experiments in which similar volumes of water have been successively passed over weirs with and without end contractions may be utilized to determine the effect of such contractions.

It may be added that a more elaborate study of end contractions is desirable. It is to be borne in mind, however, that to secure greater accuracy in this regard a more complicated or variable correction than that of Francis must probably be used, and the result will be to greatly increase the labor of weir computations in the interest of what is usually a comparatively small matter, the better remedy being probably the use of weirs with end contractions suppressed, wherever practicable.

[a] Smith, Hamilton, Hydraulics, pp. 118–123. Smith's critical discussion of this subject will be found of value in calculating discharge for weirs with partially suppressed contraction either at sides or bottom.

COMPOUND WEIR.

A weir with a low-water notch depressed below the general crest level may sometimes be used to advantage in gaging small, variable streams. The discharge over such a weir, constructed with end contractions on both sections, can be calculated as for two separate weirs, the lower short section having end contractions for all heads. The flow over the two upper sections is computed as for a suppressed weir.

Such a weir has been used for the determination of the low-water flow of very small streams, for which purpose it is well adapted, the entire stream when at low stages flowing in the central notch, in a stream relatively deep and narrow.

The measurement of very thin sheets of water on a broad weir is subject to peculiar difficulties, including uncertainty of coefficient, adhesion of nappe to weir face, dispersion by winds, and a large percentage error in the results if there is a small error in measuring the head.

TRIANGULAR WEIR.

GENERAL FORMULA.

Referring to fig. 4, we may write

$$l : H-y :: L : H.$$

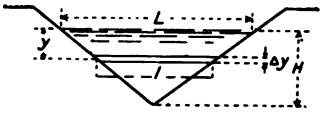

FIG. 4.—Triangular weir.

Substituting, in equation (4),

$$Q = \int_0^H \sqrt{2gy}\,\frac{L(H-y)}{H}\,dy$$

$$= \frac{4}{15}\,L\,\sqrt{2g}\,H^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (42)$$

THOMSON'S EXPERIMENTS.

The mean coefficient of contraction for a thin-edged triangular weir deduced experimentally by Prof. James Thomson, of Belfast, is $M = 0.617$,[a] the formula being

$$Q = \frac{4}{15}ML\,\sqrt{2g}\,H^{\frac{3}{2}} = 1.32LH^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad (43)$$

[a] British Association Report, 1858 (original not consulted). Merriman gives the mean value of M for heads between 0.2 and 0.8 foot as 0.592.

For a right-angled notch,

$$L=2H \text{ and } Q=2.64H^{\frac{5}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (44)$$

The length of the contracting edges in a triangular notch being proportional to the depth, it is believed that the coefficient of discharge is somewhat more constant than for a rectangular weir.[a]

TRAPEZOIDAL WEIR.

The discharge in this case may be determined directly from the integral formula (4) as for a triangular weir, by integrating between the limits AD and CE, fig. 5. It may also be derived as follows:

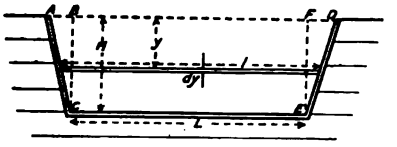

FIG. 5.—Trapezoidal weir.

z=slope of one side to the vertical.

$$Q=\int_{y=o}^{y=H} \sqrt{2g}\,y\,[L+2z\,(H-y)]\,dy$$

By integration,

$$Q=\frac{2}{3}\sqrt{2g}\,LH^{\frac{3}{2}}+\frac{8}{15}z\sqrt{2g}\,H^{\frac{5}{2}} \quad . \quad . \quad . \quad . \quad . \quad (45)$$

in which coefficients of contraction for the horizontal crest and for the end slopes must be introduced.

THE CIPPOLETTI TRAPEZOIDAL WEIR.

The discharge over a trapezoidal without contraction would be the sum of that for a rectangular weir added to that for two triangular weirs forming the ends. From the experiments of James B. Francis[b] it appears that each end contraction reduces the effective length of the weir $0.1H$. The contraction decreases the discharge by the amount

$$Q=\frac{2}{3}\,M\times 0.1H\sqrt{2g}\,H^{\frac{3}{2}}=\frac{2}{3}\,\frac{M}{10}\sqrt{2g}\,H^{\frac{5}{2}}$$

If the ends of the weir, instead of being vertical, are inclined outward in such manner that the discharge through the added area counterbalances the decrease from the end contraction, then the effective

[a] The coefficient 2.64 is the same as that deduced for broad crest weirs with stable inppe. A table of values of $2.64H^{\frac{5}{2}}$ is given on page 177, which may be applied in calculating flow over triangular weirs.

[b] *Lowell Hydraulic Experiments.*

length of the weir will remain constant as the head increases, the sam as in a suppressed weir. The discharge through the end triangle ABC will be, from equation (42),

$$Q=\frac{4}{15}Mz\sqrt{2g}H^{\frac{3}{2}}$$

Where z is the width or base of the end triangle. Equating th two expressions for Q, and solving for z, we find, assuming M to hav the same value in both cases,

$$z=\frac{1}{4}H \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (4$$

This condition defines the Cippoletti weir.[a]

CIPPOLETTI'S FORMULA.

Cippoletti derived his formula from a discussion of the experiment of James B. Francis, selecting a coefficient 1 per cent greater, makin

$$Q=\frac{2}{3}\times 0.629\ LH\sqrt{2g}H=3.367LH^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad (4$$

L is the length of the crest or base of the trapezoid.

Flinn and Dyer[b] experimented at the testing flume of the Holyok Water Power Company by passing the same volume of water succe sively over a trapezoidal experimental weir and over the gaging we of the turbine testing flume 19.7 feet downstream. The latter, it stated, complied in form with Francis's specifications.

The depths were observed by hook gage; eleven readings, as a rul being taken and their arithmetical mean used for the determination a head. The thirty-two series of valid experiments range from 0 foot depth on a weir with sill length of 3 feet to a head of 1.25 feet c a sill 9 feet long.

The discharge over the standard weir was calculated by the formula of J. B. Francis and of Hamilton Smith. The correction for velocit of approach at the experimental weir was made by the formula Hamilton Smith, for use with contracted rectangular weirs,

$$H=D+1.4h.$$

Flinn and Dyer's coefficients are as follows:

Mean of 32 experiments,	$C=3.283$
Mean after rejecting 5 diminished weights,	$C=3.301$

In general, the coefficient diminished as the head increased, suggesing that the end inclination should slightly exceed $\frac{1}{4}H$ in the Cippolet weir, to provide complete compensation, and that the end contractio

[a] First described by Cesare Cippoletti in Canal Villoresi, Modulo per la Dispensa delle Acque, 18
[b] *Flinn, A. D., and Dyer, C. W. D.*, The Cippoletti trapezoidal weir. Trans. Am. Soc. C. E., vol. *1894, pp. 9-33.*

coefficient in the trapezoidal weir may be greater than $0.1H$, as used by Francis.

The question is complicated by velocity of approach. For example, had the Francis velocity-correction formula been used by Flinn and Dyer, their values of C would have been larger. As a tentative conclusion it is probable that the application of either the Francis formula with his velocity-head correction or the Flinn and Dyer coefficient with the Smith velocity correction will, when applied to a Cippoletti weir, give results as accurate as the precision of the coefficients will justify.

REQUIREMENTS AND ACCURACY OF WEIR GAGINGS.

PRECAUTIONS FOR STANDARD WEIR GAGING.

Certain specifications were laid down by James B. Francis as guides in cases where the utmost precision is desired in weir measurements.[a] The limits of applicability of the weir have been greatly extended since 1852, and some of the uncertainties as to the effect of various modifications of weir construction have been removed.

In general, for standard thin-edged weirs—

1. The upstream crest edge should be sharp and smooth.
2. The overflowing sheet should touch only the upstream crest corner.
3. The nappe should be perfectly aerated.
4. The upstream face of the weir should be vertical.
5. The crest should be level from end to end.
6. The measurements of head should show the true actual elevation of water surface above the level of the weir crest.
7. The depth of leading channel should be sufficient to provide complete crest contractions, and, if they are not suppressed, the width of channel should be sufficient to provide complete end contractions.
8. A weir discharging from a quiet pond is to be preferred. If this is not available, the velocity of approach in the leading channel should be rendered as uniform as possible and correction made therefor by the method employed by the experimenter in deriving the formula.

In order to fulfill these requirements, certain secondary conditions are necessary. The depth on the weir should be measured at a point far enough upstream from the crest to be unaffected by the surface curvature, caused by the discharge.

[a] Francis, J. B., Lowell Hydraulic Experiments, pp. 133-135.

The distance upstream to the point of measuring the head has been as follows:

Distance upstream from weir to gage used by various experimenters.

Experimenter.	Date.	Distance upstream, in feet.
Poncelet and Lesbros	1828	11.48
Lesbros	1834	11.48
Francis	1852	6.00
Hamilton Smith, jr	1874–1876	7.00
Fteley and Stearns	1878	6.00
Bazin	1886	16.40

Six feet upstream from crest is a distance frequently used, but this may be insufficient for suppressed weirs, and also for those having irregular cross sections or upstream slopes. Boileau considered the origin of the surface curvature to be at a distance from the weir equal to about 2.5 times the height of crest above the bottom of the channel of approach, indicating that for a suppressed weir the head should be measured at least this distance from the crest.[a] For a weir discharging from a still pond the head can be measured at any considerable distance from the weir. Hamilton Smith[b] states that, for weirs with full contraction, H can be measured at any convenient point from 4 feet to 10 feet from the crest.

The head may be measured directly by a graduated scale or hook gage, or by means of a piezometer tube having its orifice flush with the side wall of the leading channel, and at right angles to the direction of flow of the water.

The depth of the leading channel in Francis's experiments was 4.6 feet below crest, and Francis lays down the rule that the depth of the leading canal should be at least three times the head on the weir. Hamilton Smith fixes the minimum depth of the leading channel below the crest at $2H$.

Fteley and Stearns[c] state that the depth of the leading channel below weir crest should be at least 0.5 foot, in order that correction for velocity of approach may be reliably made for depths occurring in their measurements, and that a greater depth of leading channel is to be preferred.

To provide complete end contractions, Francis states that the distance from the side of the channel of approach to the end of the weir overflow should be at least equal to the depth on the weir. Hamilton

[a] Fteley and Stearns, Experiments on the flow of water, etc., Trans. Am. Soc. C. E., vol. 12, p. 47.
[b] Smith, Hamilton, Hydraulics, pp. 129–131.
[c] Ibid., pp 112–114.

Smith considers that the distance from the end of the weir to the side of the channel should be at least $2H$, and that the depth of channel below crest, also the side distance, should in no case be less than 1 foot. Francis further specifies that the length of weir crest should be at least three times the depth of overflow. The nappe should not be allowed to expand laterally immediately below a suppressed weir.

In order that the nappe may be perfectly aerated, Francis considers that the fall below crest level on the downstream side should be not less than $\frac{1}{2}H$, increasing for very long weirs or in cases where the downstream channel is shallow. He found, however, no perceptible difference in the discharge for a head of 0.85 foot, whether the water on the downstream side was 1.05 feet or 0.0255 foot below crest level. Fteley and Stearns and Hamilton Smith agree that, if the water is

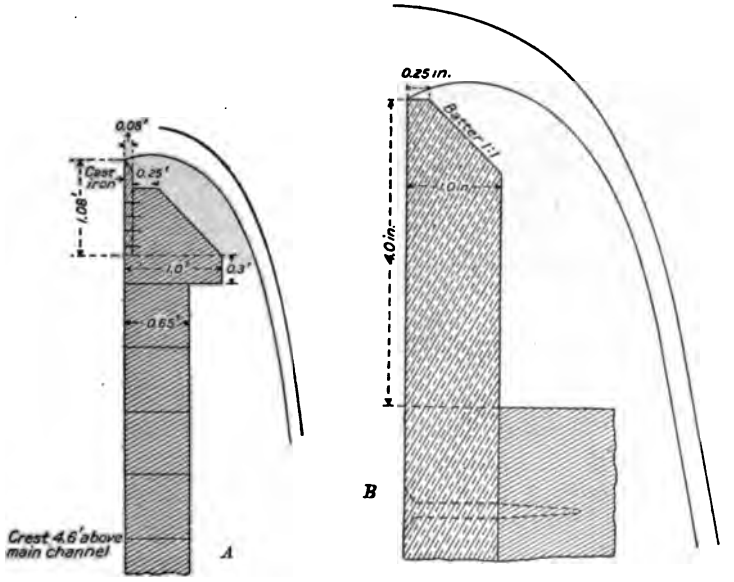

FIG. 6.—Sections of the Francis weir. *A*, General section of weir; *B*, detail of crest.

deep below, it may rise to crest level on downstream side of weir without sensible error, and Fteley and Stearns add that a weir may be submerged to a depth of 15 per cent of the head without an error exceeding 1 per cent.

The thickness of crest lip is immaterial so long as the edge is sharp and square and the nappe cuts free and is freely aerated. The latter conditions require, however, that the crest shall be thin, especially where the head is slight.

Fig. 6 shows cross sections of the crest of the weir used by James B. Francis at the Lower Merrimac locks at Lowell, in 1852, in deriving his formula. The crest consisted of a cast-iron plate 13 inches wide and 1 inch thick, planed true and smooth on all surfaces. Its upper

edge was chamfered on the downstream side at an angle of 45° to thickness of 0.25 inch at the edge. As shown, the nappe cl clear from the top of the crest in an unbroken sheet. The lowe head used by Francis was over 0.5 foot. For very low heads the cre lip should be thinner. A wooden crest tends, by capillary attractio to cause the nappe to adhere to the flat top surface under low head A wooden crest is cheap, easily adjusted, and convenient for temp rary use, but it will, in time, tend to become somewhat rounde reducing the vertical contraction of the nappe.

A cast-iron crest will usually have to be made to order. A larg steel angle bar may often be obtained from stock sizes of the rollin mills more cheaply. Such a bar, with legs, say 3 and 6 inche respectively, with the 6-inch flat face planed and its edge trued, wi form a rigid and permanent crest. The 3-inch leg may be bolted t the top of the timbers forming the body of the weir.

It may be added that approximate corrections for rounding c upstream corner of the crest, inclination of the weir upstream c downstream, or incomplete contractions can be made from data no available. In constructing gaging weirs preference, however, shoul be given to those forms which render the determination of the di charge the most simple, and the extent to which the preceding spec fications may be departed from judiciously will depend upon the ex gencies of the case and the purposes for which the results are desire

PLANK AND BEAM WEIRS OF SENSIBLE CREST WIDTH.

Experiments on weirs with crest boards 1, 2, or 4 inches in thickne were made by Blackwell, Fteley and Stearns, and Bazin. The resul show that for depths exceeding 1.5 to 2 times the crest width th nappe will break free, and if properly aerated the coefficient will the be identical with that for a thin-edged weir.

When the nappe adheres to the crest the coefficients are very unce tain for such weirs, adhesion of nappe to downstream face of cre and modified aeration entering to give divergent values.

The precise stage at which the change from an adhering to a fre nappe or the reverse occurs is not constant, but varies with velocity c approach and with rate of change of the head as the changing point i approached, being different for a sudden and for a gradual change, an also when the point of change is approached by an increasing as com pared with a decreasing head.

REDUCTION OF THE MEAN OF SEVERAL OBSERVATIONS OF HEAI

In measuring a constant volume of water, several observations c the head on the weir are desirable, the accuracy of the resul *according to* the theory of least squares, being proportional to th *square root* of the number of observations.

In weir experiments it is often impossible to maintain a perfectly uniform head or regimen. If the variations are minute the arithmetical mean may be used directly. If the variations are of wider range, or if the utmost precision is required, the following correction formula of Francis may be applied:[a]

Let D_1, D_2, D_3, etc., D_n represent the several successive observed heads.

Let t_1, t_2, t_3, etc., t_n represent the corresponding intervals of time between the several observations.

Let T represent their sum, or the total time interval.

Q=the total volume of water flowing over the weir in the time T.

D=the mean depth on the weir that would discharge the quantity Q in the time T.

L=the length of weir crest.

C=the weir coefficient.

We have, very nearly,

$$Q=\frac{t_1}{2}CLD_1^{\frac{3}{2}}+\frac{t_1+t_2}{2}CLD_2^{\frac{3}{2}}+\frac{t_2+t_3}{2}CLD_3^{\frac{3}{2}}+\text{etc.}+\frac{t_n}{2}CLD_n^{\frac{3}{2}}$$

Also,

$$Q=TCLD^{\frac{3}{2}}.$$

Equating, eliminating the common factor CL, and solving for D, we have

$$D=\left\{\frac{1}{T}\left(\frac{t_1}{2}D_1^{\frac{3}{2}}+\frac{t_1+t_2}{2}D_2^{\frac{3}{2}}+\frac{t_n+t_3}{2}D_3^{\frac{3}{2}}+\text{etc.}+\frac{t_n}{2}D_n^{\frac{3}{2}}\right)\right\}^{\frac{2}{3}} \quad (48)$$

EFFECT OF ERROR IN DETERMINING THE HEAD ON WEIRS.[b]

Consider the formula

$$Q=CLH^{\frac{3}{2}}.$$

Differentiating, we have

$$dQ=\frac{3}{2}CL\sqrt{H}\,dH.$$

The error of any gaging when $H+dH$ is taken as the head instead of the true head H being used will be dQ, and the ratio of this quantity to the true discharge Q will be

$$\frac{dQ}{Q}=\frac{\frac{3}{2}CL\sqrt{H}}{CLH^{\frac{3}{2}}}dH=\frac{3}{2}\frac{dH}{H} \quad \ldots\ldots \quad (49)$$

This formula will give nearly the correct value of the error if the increment dH approaches an infinitesimal.

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[a] Francis, J. B., Lowell *Hydraulic* Experiments, p. 113.

[b] *Rafter, G. W., On the flow of water over dams*: Trans. Am. Soc. C. E., vol. 44, p. 686; data here given based on discussion by Walter C. Parmley.

In the following table is shown the effect of errors of one sandth, five thousandths, one hundredth, and five hundredth respectively, for various heads. This clearly illustrates the necessity of proper care and the folly of ultra precision in mea the relatively large values of H with which we are mainly con The curves of error on Pl. II are equilateral hyperbolas, whic been reduced to straight lines by plotting on logarithmic scales

Percentage error in discharge resulting from various errors in the measured head

Head, in feet.	Error in measured head, in feet.			
	0.001	0.005	0.01	0.05
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
0.1	1.5	7.5	15	.....
.5	.3	1.5	3	15
1.0	.15	.75	1.5	7.5
5.0	.03	.15	.3	1.5
10.0	.015	.075	.15	.75

An error of a half-tenth foot under 5 feet head causes th error in the result as an error of one-half hundredth foot with of one-half foot.

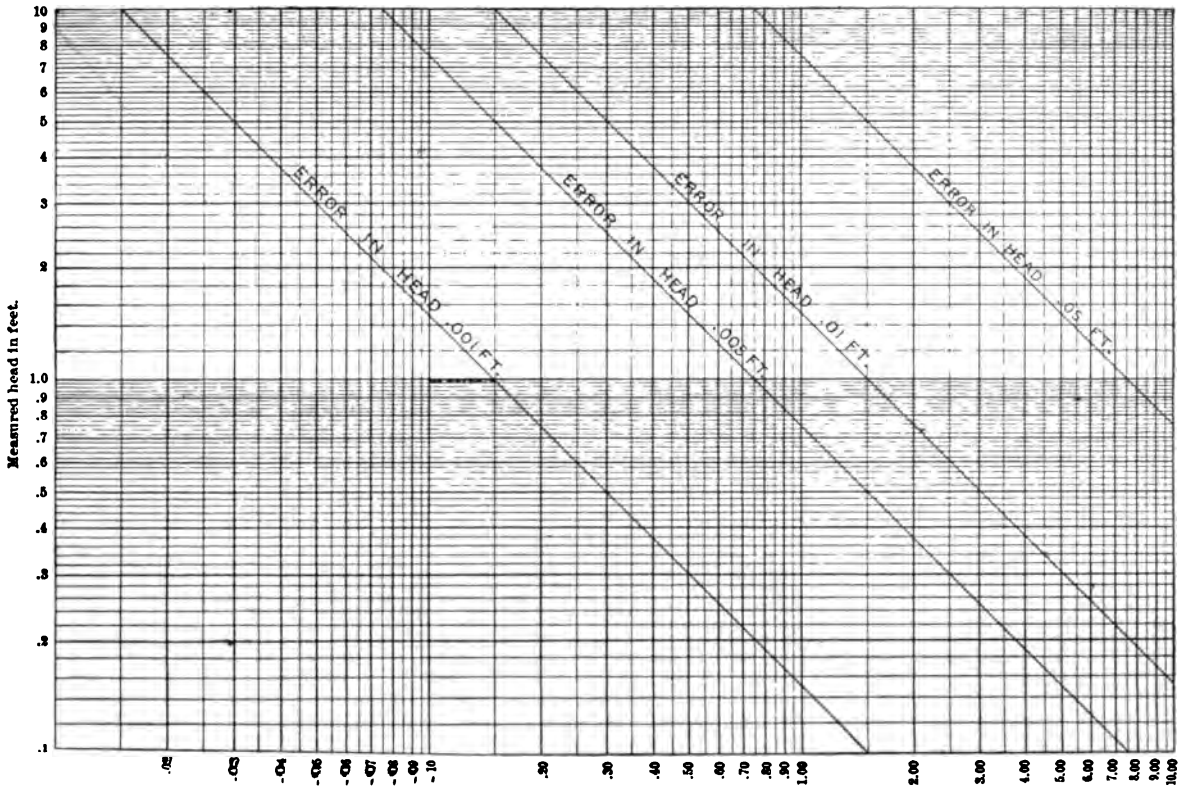
In weir experiments it is important to know the effect of a in head H on the resultant coefficient of discharge C. The err is evidently equivalent to the error in Q found above, wher constant.

ERROR OF THE MEAN WHERE THE HEAD VARIES.

In determining the volume of flow over dams where gaging are kept, the method usually pursued has been to have reading twice daily, as at morning and evening, showing the depth over the crest of the dam. The average of the two readings f day has been found and the volume of flow corresponding average head has been taken as the mean rate of flow over th for the day.

It is evident, however, that as the discharge varies more than the head (usually considered to be proportional to the three power of the head), the volume of discharge obtained as described will be somewhat less than the amount which actually over the dam. The following analysis has been made to sh magnitude of the error introduced by using the above method.

Assuming that the initial depth on the crest of the dam is ze increases at a uniform rate to H_2 at the end of a time interval



EFFECT OF ERRORS IN WEIR MEASUREMENTS.

mean head deduced from observations at the beginning and end of the period would be $\frac{1}{2} H_2$, the head at any time t would be

$$H = ft$$

where f is a constant.

We may write the usual formula for weir discharge $Q = CLH^{\frac{3}{2}}$; then, if the head varies from zero to H_2, the total volume of flow in the time T will be

$$Q_t = \int_0^T Q dt = CLf^{\frac{3}{2}} \int_0^T t^{\frac{3}{2}} dt = \frac{2}{5} CLf^{\frac{3}{2}} T^{\frac{5}{2}} \quad . \quad . \quad . \quad (50)$$

The total discharge corresponding to the average head $\frac{1}{2} H_2$ is

$$Q_{av} = CL\left(\frac{H_2}{2}\right)^{\frac{3}{2}} T = CL\left(\frac{f}{2}\right)^{\frac{3}{2}} T^{\frac{5}{2}} \quad . \quad . \quad . \quad . \quad (51)$$

The ratio of the discharge is

$$\frac{\text{Volume by average head}}{\text{Actual volume}} = \frac{Q_{av}}{Q_t} = \frac{\left(\frac{1}{2}\right)^{\frac{3}{2}}}{\frac{2}{5}} = 0.8840 \quad . \quad . \quad (52)$$

or, True discharge $= 1.13 \times$ discharge by average head.

This percentage of error is the same whatever may be the maximum head (H_2), and whether the stream is rising or falling, provided the initial head is zero. If there is an initial depth H_1 flowing over the dam, the error from computing the discharge by the mean head will decrease as the ratio H_1 / H_2 increases.

In case the head increases uniformly, and the total discharge Q' is taken from the average of the initial and terminal discharges, and if $H_1 = 0$

then

$$\frac{Q'}{\text{true } Q} = \frac{\frac{1}{2} CL\,(fT)^{\frac{3}{2}} \times T}{\frac{2}{5} CLF^{\frac{3}{2}} T^{\frac{5}{2}}} = 1.25$$

If the discharge increases at a uniform rate, then the true mean discharge will be, of course,

$$\frac{Q_1 + Q_2}{2}.$$

Conditions similar to those above discussed occur at milldams during the season of low water, when the pond is allowed to fill up at night and the water is drawn down to crest level or below during the day when the mills are *running*. In some cases the inflow to the pond is *nearly uniform and the* head and discharge increase at a diminishing

rate. In other cases the inflow to the pond varies. In all such where it is desired to determine the discharge during any perio the initial and terminal heads, the method of calculation whi give the most accurate result must be determined from the d judgment.

The following example will illustrate the use of equation (52). pose a sharp-crested weir without end contractions, with crest long, on which the water rises to a depth of 1 foot in a perio seconds—

Mean depth on a weir with varying head.

Time, in seconds	1	2	3	4	5	6	7	8	9
Head, in feet, at end of each second	.1	.2	.3	.4	.5	.6	.7	.8	
Average head for period	.05	.1	.15	.2	.25	.3	.35	.4	
Average head, second to second	.05	.15	.25	.35	.45	.55	.65	.75	

Using the average head during each second the volume of flo be approximately integrated by finite differences, as follows, t charge being taken from Francis's tables:

Discharge over a weir with varying head.

Time, in seconds.	Average head, in feet.	Discharge, in second-feet.
0 to 1	0.05	0.037
1 to 2	.15	.194
2 to 3	.25	.416
3 to 4	.35	.690
4 to 5	.45	1.005
5 to 6	.55	1.358
6 to 7	.65	1.745
7 to 8	.75	2.163
8 to 9	.85	2.609
9 to 10	.9	3.083
Total		13.30

The average head for the entire period, 0.5 foot, gives a dis for 10 seconds of 11.773 second-feet, or 88.5 per cent of that above, the numerical result agreeing closely with that obtai analysis. The volume of flow from average head equals seven- of the true integral volume of flow, approximately.

WEIR NOT LEVEL.

If the crest of a gaging weir is not truly horizontal, but is a little inclined, the discharge may be closely approximated by the use of the average crest depth H in the ordinary formula, or more precisely by the formula below, applicable also to weirs of any inclination.

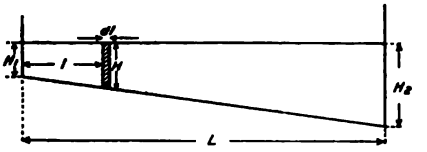


FIG. 7.—Inclined weir.

The flow through the elementary width dl is

$$dQ = CH^{\frac{3}{2}}dl$$

$$H = H_1 + \frac{H_2 - H_1}{L} l$$

$$\text{Total discharge} = Q = \int_0^L CH^{\frac{3}{2}}\,dl = C' \int_0^L \left(H_1 + \frac{H_2 - H_1}{L} l\right)^{\frac{3}{2}} dl$$

Integrating,

$$Q = \frac{2CL}{5\left(H_2 - H_1\right)}\left(H_2^{\frac{5}{2}} - H_1^{\frac{5}{2}}\right) \quad . \quad . \quad . \quad . \quad . \quad (54)$$

In this formula either the mean coefficient deduced by Thomson (see p. 46) for a triangular weir, in which $\frac{2}{5}C = 1.32$, or that of Francis, in which $\frac{2}{5}C = 1.332$, may be used. If there are end contractions, the net length,

$$L = L' - 0.2\left(\frac{H_2 + H_1}{2}\right),$$

should be used.

The discharge using the average head,

$$H_a=\frac{H_2+H_1}{2},$$

is

$$Q=CL\left(\frac{H_2+H_1}{2}\right)^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad .$$

The extent of variation from the true discharge resulting fron use of formula (55) in place of the integral formula (54) is illust by the following:

Let $L=10$ feet, $H_a=1.0$ foot, $\frac{2}{5}C=1.332$.

Discharge by (55) for average head=33.30 cubic feet per sec
If $H_2-H_1=0.01$ foot—true discharge, $Q=33.30$ cubic feet per sec
If $H_2-H_1=0.10$ foot—true discharge, $Q=33.30$ cubic feet per sec
If $H_2-H_1=0.50$ foot—true discharge, $Q=33.54$ cubic feet per sec

In general, since the discharge varies more rapidly than the h the effect of calculating the discharge from the average head wi to give too small discharge, the error increasing with the variati crest level.

Hence the discharge obtained by using the average crest level weir having an inclined or uneven crest will be somewhat defic The magnitude of the variations in height of the crest will deter whether the average profile can be used or whether the crest shou subdivided into sections, each comprising portions having very n the same elevation (whether adjacent or not), and the discharge each section computed as for a separate weir.

In general it may be stated that the error in the value o increases directly in proportion as the ratio of the difference in limiting heads to the average head is increased.

CONVEXITY OF WATER SURFACE IN LEADING CHANNEL

If there are wide variations in velocity in the measuring section level of the water surface may be affected, since water in m exerts less pressure than when at rest.

Conditions of equilibrium cause the swift-moving current to above the level of the slower-moving portions. If the head is n ured near still water at the shore, the result may be slightly too s

The difference in height[a] may be expressed in the form,

$$D_2-D_1=r\frac{v'_2{}^2-v'_1{}^2}{2g} \quad . \quad . \quad . \quad . \quad . \quad . \quad .$$

The coefficient r is often assumed equal to unity, but evid varies with the distribution of velocities whose resultant effe measures.

[a] Humphreys and Abbot, Physics and Hydraulics of the Mississippi River, 1876, p. 350.

RESULTS OF EXPERIMENTS ON VARIOUS FORMS OF WEIR CROSS SECTIONS.

THE USE OF WEIRS OF IRREGULAR SECTION.

Many cases arise where it is desired to estimate, approximately, at least, the flow over dams of peculiar cross section.

The construction of so-called standard or thin-edged weirs that shall be permanently useful to measure the flow of large and variable streams is so difficult and expensive as to be frequently impracticable. Existing milldams often afford a convenient substitute. In the following pages are presented the results of the leading experiments to determine proper coefficients for "irregular" weirs, followed by a grouping of experiments on similar models, whether all by one experimenter or not. The data are not always as complete or consistent as could be desired, but the need for fair working coefficients is very great, and, in the line of making use of all the available information, the several diagrams of comparison and the conclusions therefrom are presented, with the understanding that these are not final, although it is quite certain that the laws of coefficient variation are correctly outlined by the data at present available, and they form, therefore, a safe working hypothesis.

Weir models of irregular section are calibrated in order that existing dams of similar cross section may be used for stream gaging. It becomes necessary to calibrate the experimental models for a wider range of heads than has commonly been employed in experiments on standard thin-edged weirs, in order that the range of rise and fall of the stream from low water to high may be included.

While the recent experimental data include heads as great as from 4 to 6 feet, yet it is often necessary to determine the discharge for still greater heads, and experiments on certain forms with heads up to 10 or 12 feet are needed.

In this connection the greater relative facility of securing accurate results with weirs for high than for low heads may be noted.

The proportional error resulting from variations in crest level, as well as uncertainties as to the nappe form and consequent value of the coefficient, largely disappear as the head increases. The effect of form of crest and friction is also relatively diminished. It is probably true that the coefficients for many ordinary forms of weir section would tend toward a common constant value if the head were indefinitely increased. The above facts render milldams especially useful for the determination of the maximum discharge of streams. Dams can be used for this purpose when the presence of logs and drift carried down by the flood preclude the use of current meters or other gaging instruments.

MODIFICATIONS OF THE NAPPE FORM.

The elaborate investigations of Bazin relative to the physics of we discharge set forth clearly the importance of taking into considerati the particular form assumed by the nappe. This is especially true weirs of irregular section in which there is usually more opportun i for change of form than for a thin-edged weir. In general the nap may—

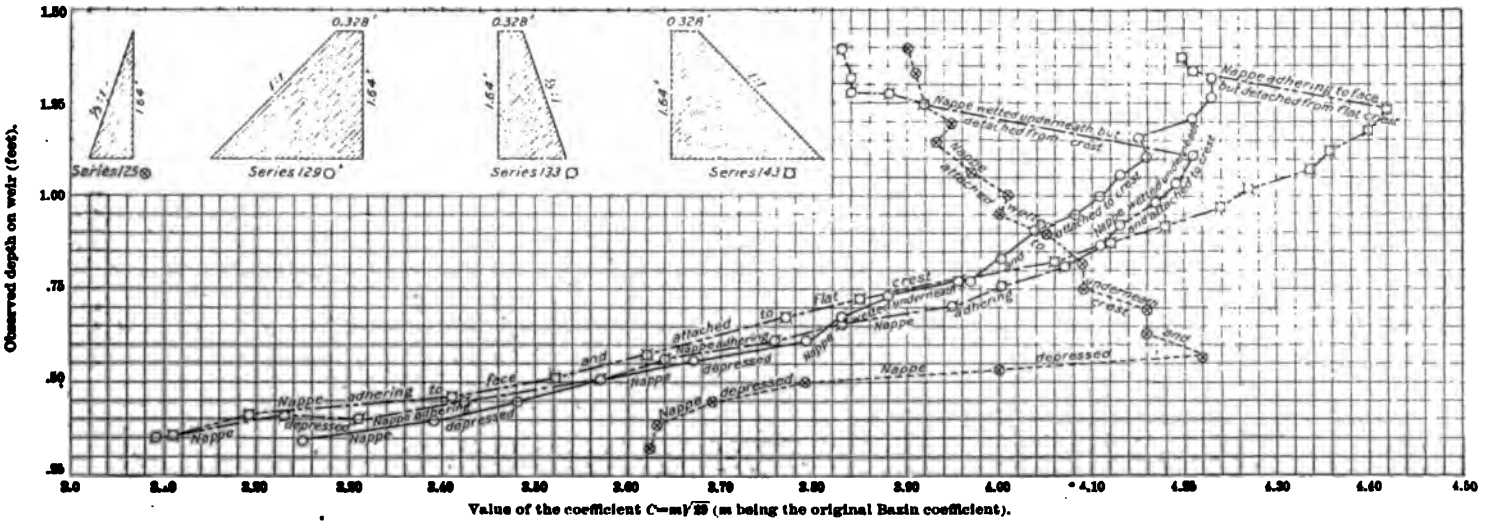
1. Discharge freely, touching only the upstream crest edge.
2. Adhere to top of crest.
3. Adhere to downstream face of crest.
4. Adhere to both top and downstream face.
5. Remain detached, but become wetted underneath.
6. Adhere to top, but remain detached from face and become wett underneath.
7. In any of the cases where the nappe is "wetted underneath" th condition may be replaced by a depressed nappe, having air imprison underneath at less than atmospheric pressure.

The nappe may undergo several of these modifications in successi as the head is varied. The successive forms that appear with increasing stage may differ from those pertaining to similar stag with a decreasing head. The head at which the changes of nappe fo occur vary with the rate of change of head, whether increasing decreasing, and with other conditions.

The law of coefficients may be greatly modified or even revers when a change of form takes place in the nappe.

The effect of modifications of nappe form on various irregular we sections is shown in Pl. III. The coefficients are those of Bazin a include velocity of approach. The coefficient curve for any form weir having a stable nappe is a continuous, smooth line. When t nappe becomes depressed, detached, or wetted underneath during t progress of an experiment, the resulting coefficient curve may consi of a series of discontinuous or even disconnected arcs terminati abruptly in "*points d'arrêt*," where the form of nappe changes. T modifications of nappe form are usually confined to comparatively lo heads, the nappe sometimes undergoing several successive changes the head increases from zero until a stable condition is reached beyo which further increase of head produces no change. The conditi of the nappe when depressed or wetted underneath can usually restored to that of free discharge by providing adequate aeration.

The weir sections shown in Pl. III are unusually susceptible of chang of nappe form. Among weirs of irregular section there is a lar class for which, from the nature of their section, the nappe can assu only one form unless drowned. Such weirs, it is suggested, may, *properly calibrated*, equal or exceed the usefulness of the thin-edg



VARIATIONS IN WEIR COEFFICIENT WITH CHANGE OF NAPPE FORM.

weir for purposes of stream gaging, because of their greater stability of section and because the thin-edged weir is not free from modification of nappe form for low heads.

As an example, Bazin gives the following coefficients applying to a thin-edged weir 2.46 feet high, with a head of 0.656 foot, under various conditions:

Condition of nappe.	Bazin coefficient m.	$C=m\sqrt{2g}$	Per cent of the Francis coefficient.
Free discharge, full aeration	0.433	3.47	104.1
Nappe depressed, partial vacuum underneath	.460	3.69	110.7
Nappe wetted underneath, downstream water level, 0.42 foot below crest	.497	3.99	119.7
Nappe adhering to downstream face of weir, result at a distance	.554	4.45	133.5

These coefficients include velocity of approach effect, which tends to magnify their differences somewhat. There is, however, a range of 25 per cent variation in discharge between the extremes.[a]

The departure in the weir coefficient from that applying to a thin-edged weir, for most forms of weirs of irregular section, results from some permanent modification of the nappe form. Weirs with sloping upstream faces reduce the crest contraction, broad-crested weirs cause adherence of the nappe to the crest, aprons cause permanent adherence of the nappe to the downstream face.

EXPERIMENTAL DATA FOR WEIRS OF IRREGULAR CROSS SECTION.

The only experiments on irregular or broad-crested weirs in which the discharge has been determined volumetrically are those of Blackwell on weirs 3 feet broad, of Francis on the Merrimac dam, and of the United States Geological Survey for lower heads, on various forms of section. So far as the writer is aware, all other such experiments have been made by comparison with standard weirs.

In the following pages are included the results of the experiments of Bazin on 29 forms of cross section; also those of the United States Deep Waterways Board under the direction of George W. Rafter, and those of John R. Freeman at Cornell University hydraulic laboratory. The results of 20 series of experiments, chiefly on weirs with broad and ogee crest sections, made under the writer's direction at Cornell University hydraulic laboratory, are here for the first time published.

[a] Bazin's general discussion of the above and other modifications of the coefficient has been translated by the writer, and may be found in Rafter's paper, On the flow of water over dams: Trans. Am. Soc. C. E., vol. 44, pp. 254–261.

As it has been necessary to reduce the experimental data to a uniform basis for purposes of comparison the original data, together with the results obtained by recalculation, have been included for the Bazin, United States Deep Waterways, and Freeman experiments.

BASE FORMULA FOR DISCHARGE OVER WEIRS OF IRREGULAR CROSS SECTION.

Precedent to the opening of the hydraulic laboratory of Cornell University the most elaborate experiments on weirs of irregular cross section were those of Bazin. His experiments were all reduced in such manner as to include the velocity of approach correction in the discharge coefficient.

In America the formula most commonly used is that adopted by James B. Francis, in which velocity of approach is eliminated from the coefficient by correcting the head, thus reducing the conditions as nearly as possible to the basis of no velocity of approach before applying the formula.

In order to render Bazin's results comparable with the later experiments, it has been necessary to adopt a standard or base formula to which all the experiments should be reduced. The considerations leading to the adoption of the formula of Francis here used are given below.

In the process of gaging streams at dams the head is usually measured in comparatively still water in an open pond. This condition could not be duplicated in the Cornell experiments. As the formula of James B. Francis is most simple in form for the case of a weir with no velocity of approach, and as it is often convenient to compare the discharge over a dam with that for a thin-edged weir of standard form, a weir formula of the base form used by Francis has been adopted in reducing the experiments. In this formula,

$$Q = CLH^{\frac{3}{2}}.$$

L = Length of crest corrected for end contractions, if any.

H = Head on weir crest corrected for velocity of approach by the Francis correction formula or an equivalent method.

C = A coefficient determined from experiments on a model dam.

In this connection it may be remarked that the formula of Bazin includes the correction for velocity of approach in the weir coefficient; hence the coefficient for a given weir is comparable only with that for another weir under the same head when the velocity of approach is the same in both cases. Bazin's formula also expresses the velocity of approach implicitly by means of the depth and breadth of the leading channel. In actual gagings the leading channel is often of irregular form, hence it becomes necessary to eliminate the depth and breadth of the channel from the formula.

There is considerable variation in the magnitude of the correction for velocity of approach used by different experimenters. As a rule, the velocity of approach is negligible at gaging stations at dams. It became necessary, therefore, in reducing these experiments to determine from the measured discharge and observed head what the head would have been had the same discharge taken place over a weir in a still pond. To accomplish this the formula for correction for velocity of approach adopted by James B. Francis has been used. This being the case, it is to be noted that in applying the coefficients, which, as given, have been reduced as nearly as possible to the basis of no velocity of approach, the same method of velocity correction must be used, and if it is used no error will result where the actual velocity of approach is nearly the same as that which occurred in the experiments.

BAZIN'S EXPERIMENTS ON WEIRS OF IRREGULAR CROSS SECTION.

These include a wide variety of forms, many of which will seldom be found in America, and the use of which for purposes of gaging would be ill advised.

The small size of the models used, high velocity of approach, and narrow range of heads covered, limit the application of these results. No effort has been made to present all the results in this paper.[a] Certain series, useful for comparison, have been recomputed as described below, and by grouping similar sections we may determine the general effect of various slope and crest modifications.

BAZIN'S CORRECTION FOR VELOCITY OF APPROACH.

The base formula for weir discharge adopted by Bazin and the method of taking into account the velocity of approach are described in connection with his experiments on thin-edged weirs (p. 31).

The following discussion shows the complex character of the Bazin coefficients, and the fact that they do not express directly the relative discharging capacity of weirs of irregular section.

The effect of velocity of approach is to increase the discharge at a given observed head, D, over what it would be if the same head were measured in still water, as in a deep, broad pond.

Bazin's coefficients in the form published are not readily applicable in practice to weirs of other heights, or to weirs in ponds, or otherwise to any but weirs in restricted channels of the depth and width of the weir.

[a] For complete original data, see Bazin, as translated by Marichal and Trautwine in Proc. Engineers Club Phila., vol. 7, pp. 259-310; vol. 9, pp. 231-244, 287-319; vol. 10, pp. 121-164; also numerous experiments reduced to English units by Rafter and others, Trans. Am. Soc. C. E., vol. 44, pp. 220-398.

The Bazin coefficients as published may be considered as comprising two principal factors. M being the Bazin coefficient, we may write

$M=FC.$

$F=$velocity of approach effect.

$C=$contraction effect.

Bazin uses a correction formula for velocity of approach, derived from the expression

$$H=D+1.69\frac{v^2}{2g} \text{ or } D+\alpha h.$$

Consider a standard weir and experimental weir both of the same height, but of different form, the measured depth being the same, and the Bazin coefficients being M and m, the velocity of approach and discharge V and v and Q and q, respectively, and C and C_1 the coefficients in a formula in which the velocity of approach correction is eliminated from the coefficient and applied to the head; then the discharge for the standard weir would be,

using the Bazin coefficients,

$$Q=MLD\sqrt{2gD}=M'D^{\frac{3}{2}},$$

where $M'=M\sqrt{2g}$ and $L=1.0$;

using the coefficient C,

$$Q=CH^{\frac{3}{2}}=C(D+\alpha h)^{\frac{3}{2}},$$

taking roots

$$\left(\frac{C}{M'}\right)^{\frac{2}{3}}=\frac{D}{D+\alpha h}.$$

Bazin does not give the quantities of flow in the tables of results of his experiments, hence to determine h it is necessary to calculate Q. v, and h from the known values M and D and from P, the height of weir.

D being the same for both the standard and the experimental weirs, we have for the experimental weir

$$\left(\frac{C_1}{m}\right)^{\frac{2}{3}}=\frac{D}{D+\alpha h_1},$$

C_1 being the coefficient for the experimental weir, and h_1 the velocity head.

Hence, by multiplication,

$$\left(\frac{m}{M}\right)^{\frac{3}{2}}\left(\frac{C}{C_1}\right)^{\frac{3}{2}}=\frac{D}{D+\alpha h}\times\frac{D+\alpha h_1}{D},$$

and

$$\left(\frac{m}{M}\right)^{\frac{3}{2}}=\left(\frac{C_1}{C}\right)^{\frac{3}{2}}\times\frac{D+\alpha h_1}{D+\alpha h},$$

or

$$\frac{m}{M}=\frac{C_1}{C}\times\left(\frac{D+\alpha h_1}{D+\alpha h}\right)^{\frac{2}{3}}.$$

The velocity of approach for a given depth on a weir is proportional to C, hence, since h is proportional to v^2, we have

$$\frac{h_1}{h}=\left(\frac{C_1}{C}\right)^2.$$

Hence,

$$\frac{m}{M}=\frac{C_1}{C}\left(\frac{D+\left(\frac{C_1}{C}\right)^2\alpha h}{D+\alpha h}\right)^{\frac{2}{3}} \quad \ldots\ldots \quad (57)$$

The ratio $\frac{m}{M}$ used by Bazin is not, therefore, precisely a measure of the relative discharging capacities of the two weirs under similar conditions of head and velocity of approach, for the reason that the velocity of approach will not be the same for both weirs if the Bazin coefficients are different. The ratio $m\ M$ is made up of two factors, one of which, C_1 / C, expresses the absolute relative discharging capacities of the two weirs under similar conditions of head and velocity of approach, and the other expresses the effect of the change in discharging capacity on the velocity of approach for a given depth on a weir of given height.

Thus the coefficient M for any weir has, by Bazin's method of reduction, different values for every depth and for every height of weir that may occur.

For reasons elsewhere stated it is preferred to express by $\frac{C}{C_1}$ only he relative discharging capacities of the weirs where the velocity of pproach is the same in both. It is then practically a measure of the ertical contraction of the nappe, and is constant for a given head for ny height of weir, and may be sensibly constant for various depths n the weir.

RECOMPUTATION OF COEFFICIENTS IN BAZIN'S EXPERIMENTS.

In reporting the results of his experiments on weirs of irregul section, Bazin gives the observed heads on the standard weir of cor parison, the absolute coefficient m applying for each depth on t experimental weir and the ratio m/M of the experimental and standa weir coefficients.

The results give coefficients which strictly apply only to weirs havi both the same form of section and the same heights as those of Bazi Although weirs of *sectional form* geometrically similar to Bazin's a common, yet few actual weirs have the same height as his. The appear to be two elements which may render inaccurate the applic tion of Bazin's absolute coefficients to weirs of varying height: (1) Tl difference in velocity of approach; (2) the difference in contraction the nappe for a higher or lower weir.

In order to render the results of Bazin's experiments comparab one with another and with later experiments, a number of series ha been recomputed, the velocity of approach being treated in the san manner as in the computation of experiments at Cornell hydraul laboratory.

The method is outlined below, the references being to the tables Bazin's experiments given on pages 68 to 81.

Column 2 gives the observed head reduced to feet for the expe mental weir.

Column 4 the absolute coefficient $C_1 = m\sqrt{2g}$.

(These have been reduced from Bazin's original tables.)

Column 5 gives the discharge per foot of crest over the experimen weir calculated by the formula

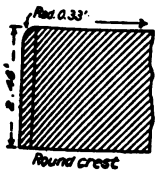
$$Q = mLD\sqrt{2gD} = C_1 LD^{\frac{3}{2}},$$

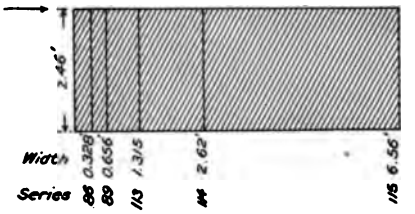
quantities in column 3 being taken directly from a table of three-halv powers.

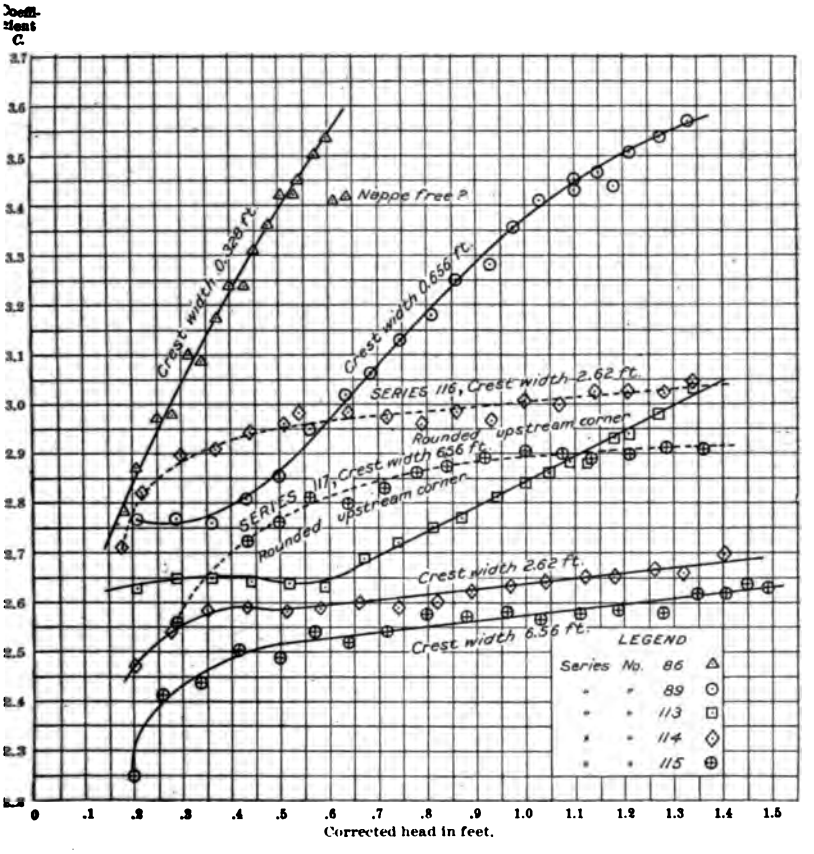
In column 6 the actual velocity of approach, $v = \frac{Q}{P+D}$, is give and in column 7 the velocity head, $h = \frac{v^2}{2g}$.

The discharge over the standard weir was calculated by Bazin using his own formula and velocity of approach correction. He do not give the discharge, however, and we have been obliged to wo back and obtain it from the data given for the experimental weir.

Having determined the actual discharge and the observed head, are now at liberty to assume such a law of velocity of approach cc rection in deducing our new coefficients as we choose. We will ther fore deduce the coefficients in such form that when applied to a we

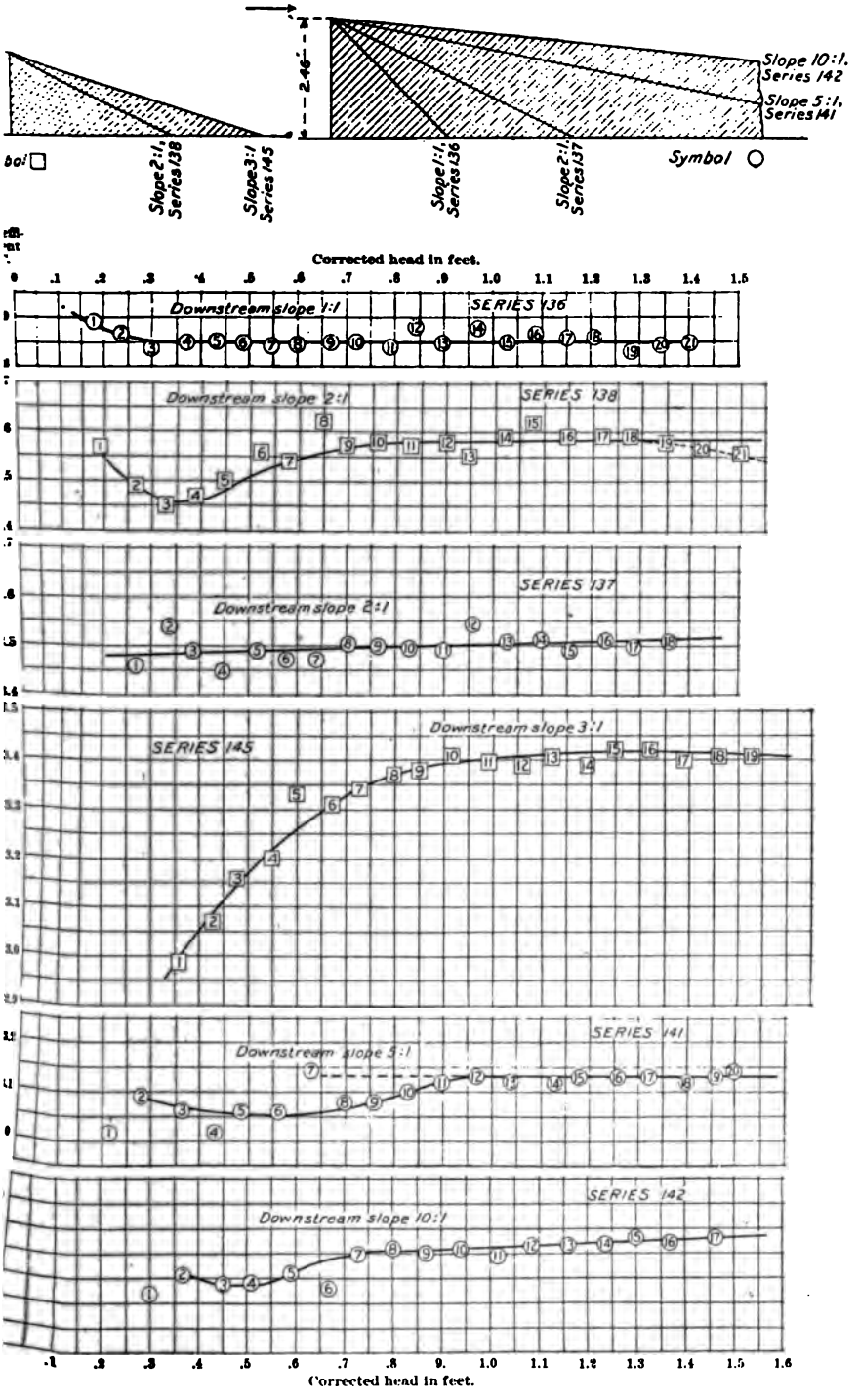






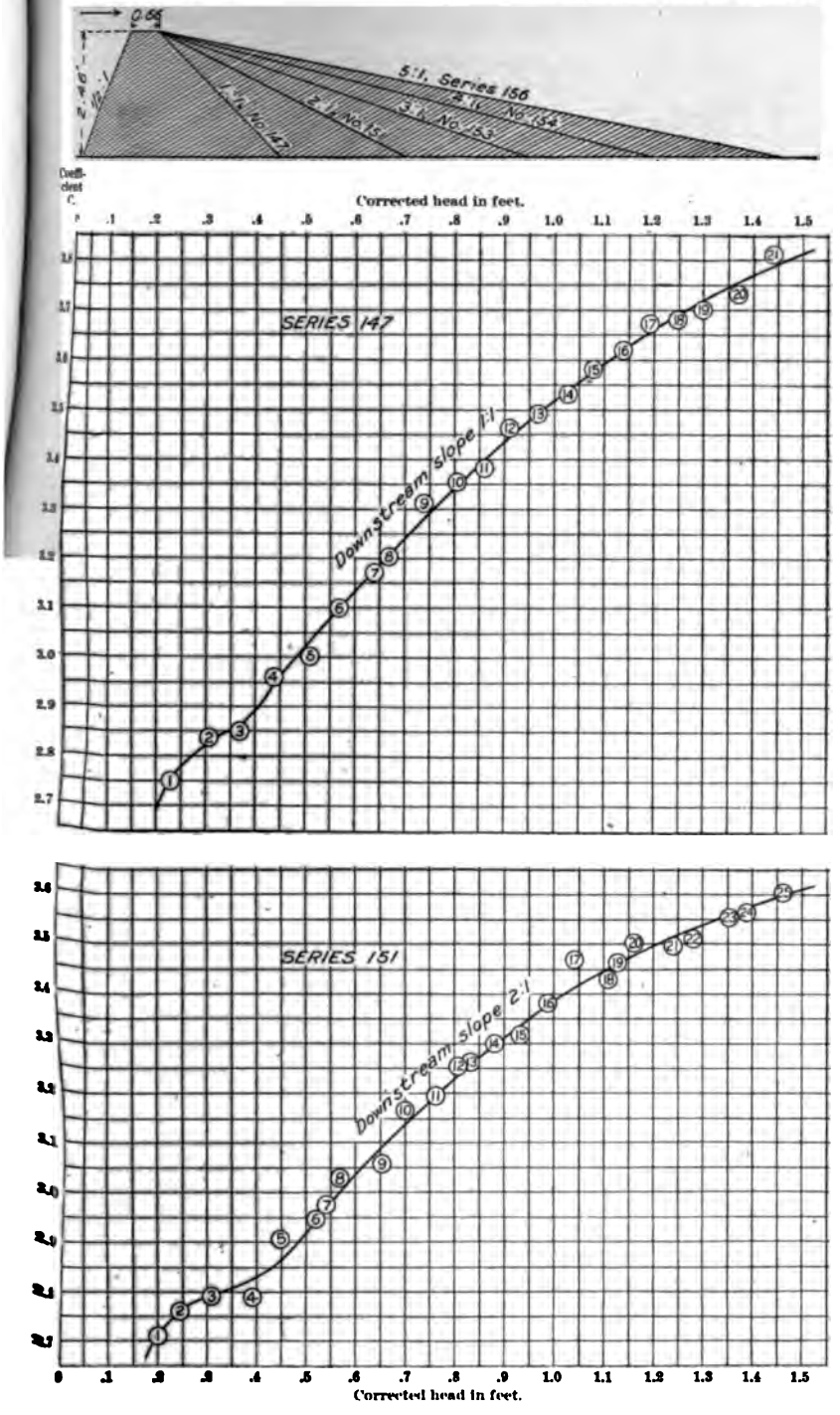
EXPERIMENTS OF BAZIN ON BROAD-CRESTED WEIRS.

Velocity-of-approach correction by the Francis method.



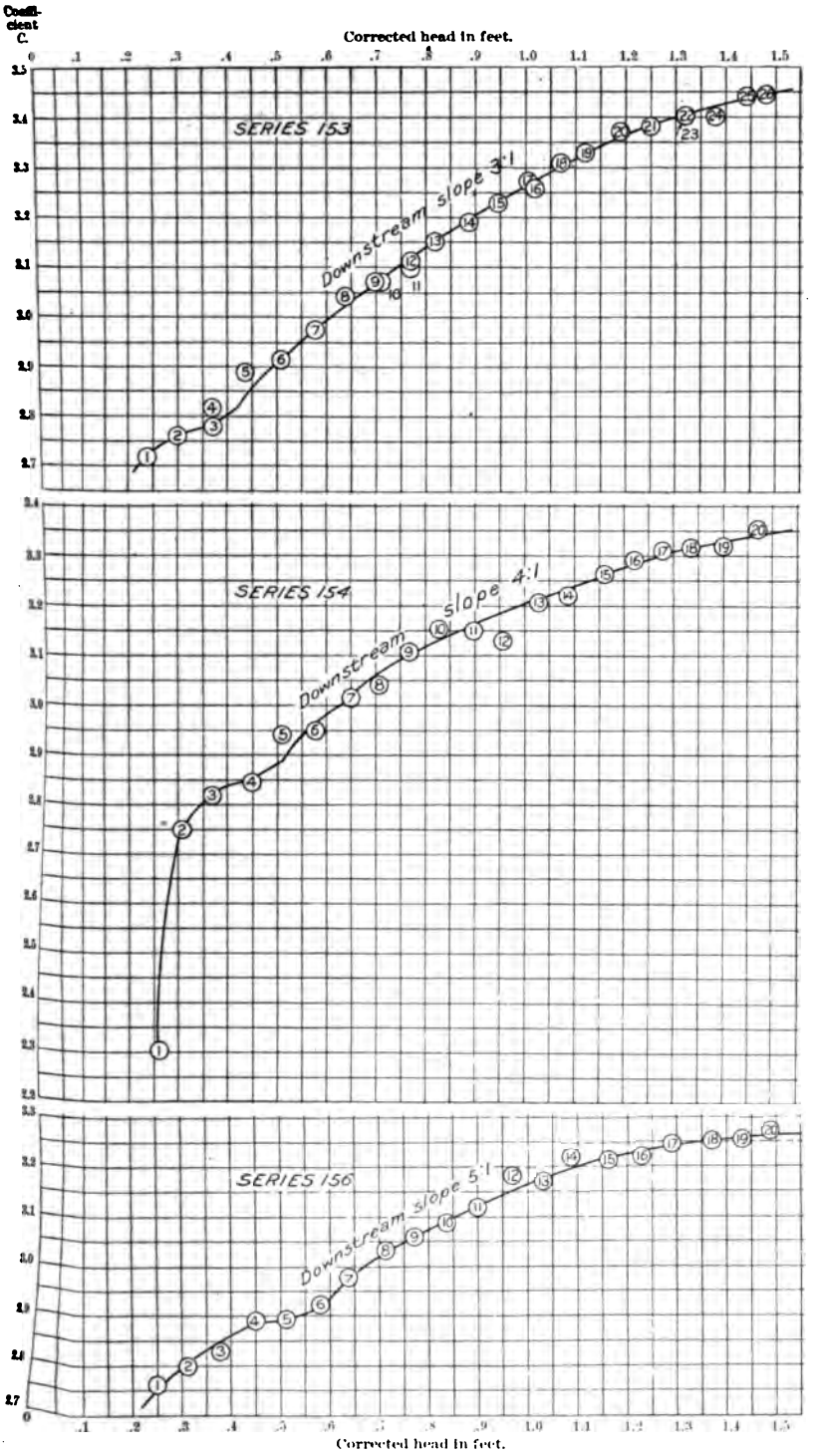
EXPERIMENTS OF BAZIN ON WEIRS OF TRIANGULAR SECTION WITH VARYING DOWNSTREAM SLOPE.

Velocity-of-approach correction by the Francis method.



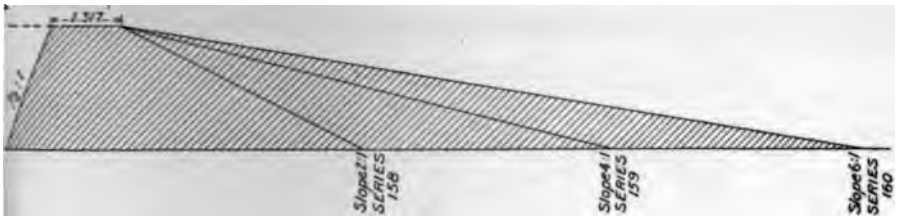
EXPERIMENTS OF BAZIN ON WEIRS OF TRAPEZOIDAL SECTION WITH VARYING DOWNSTREAM SLOPE.

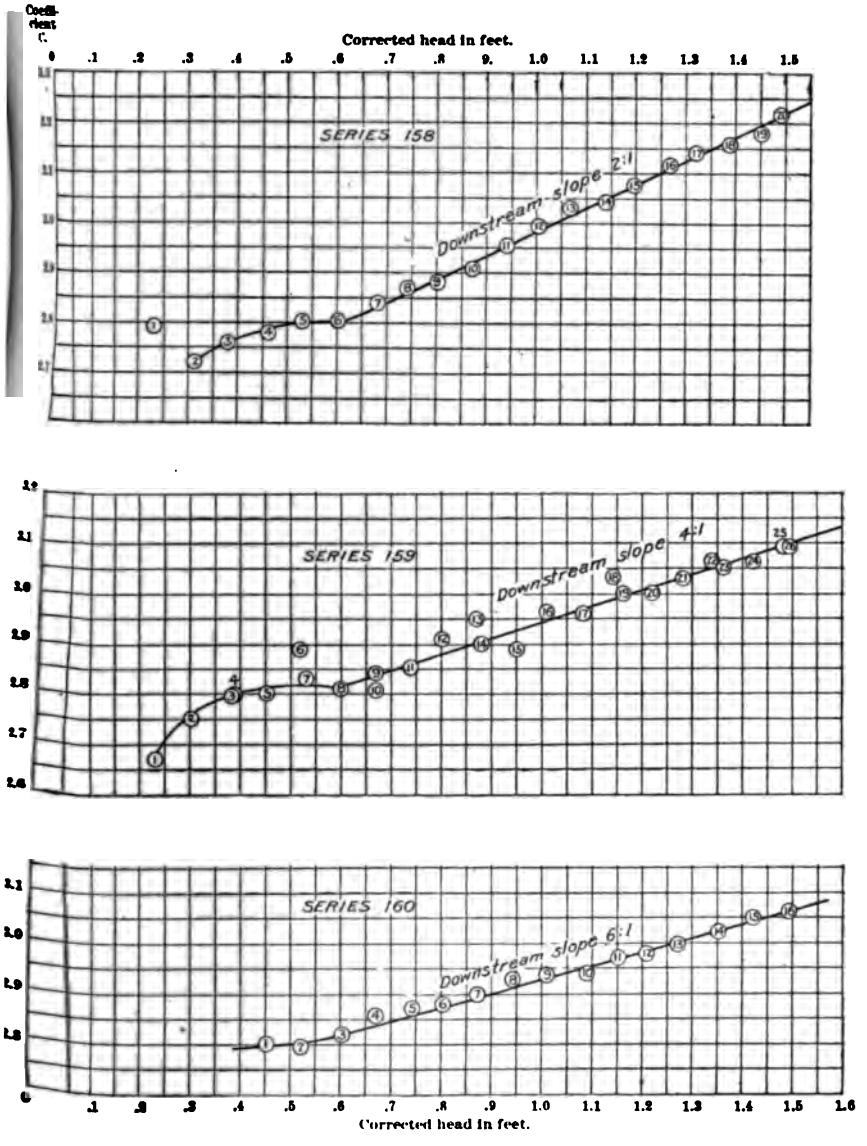
Velocity-of-approach correction by the Francis method. (See also Pl. VIII.)



EXPERIMENTS OF BAZIN ON WEIRS OF TRAPEZOIDAL SECTION WITH VARYING DOWNSTREAM SLOPE.

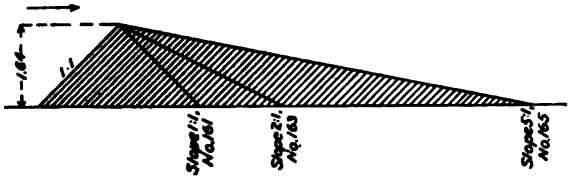
Velocity-of-approach correction by the Francis method. (For cross section see Pl. VI.)

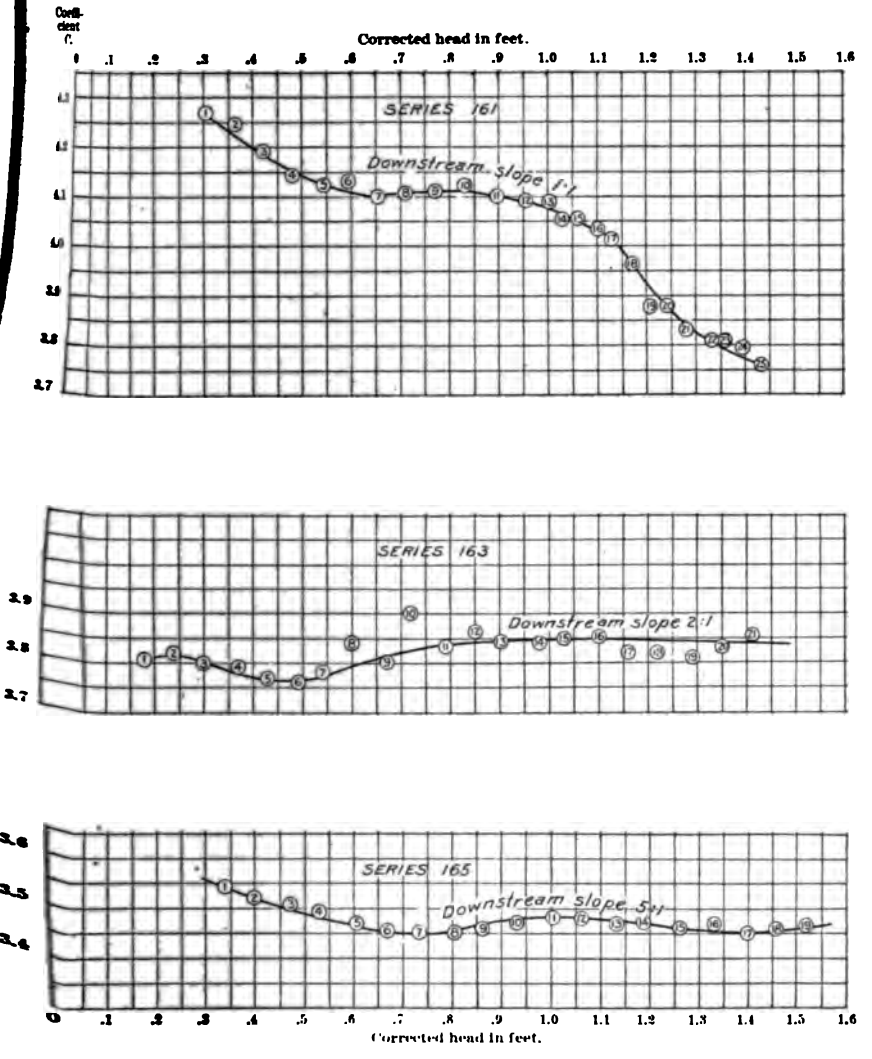




EXPERIMENTS OF BAZIN ON WEIRS OF TRAPEZOIDAL SECTION WITH VARYING DOWNSTREAM SLOPE.

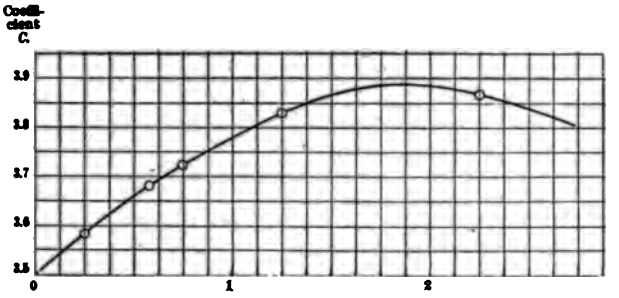
Velocity-of-approach correction by the Francis method



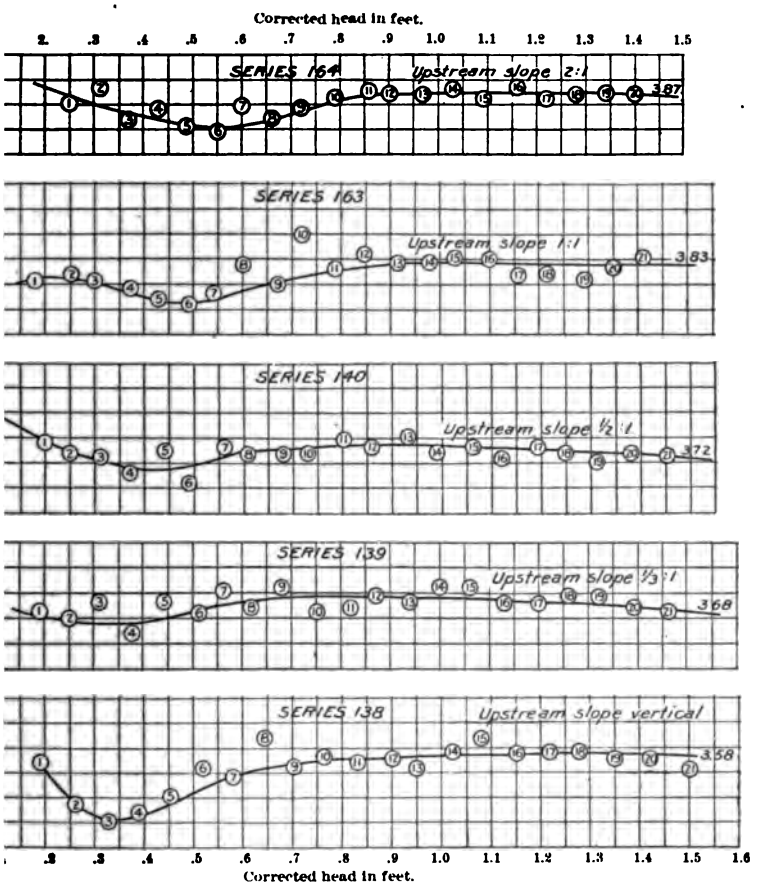

Coefficient C.
Corrected head in feet.
0 .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0 1.1 1.2 1.3 1.4 1.5 1.6
SERIES 161
Downstream slope 1:1
SERIES 163
Downstream slope 2:1
SERIES 165
Downstream slope 5:1
Corrected head in feet.

EXPERIMENTS OF BAZIN ON WEIRS OF TRIANGULAR SECTION WITH VARYING DOWNSTREAM SLOPE.

Velocity-of-approach correction by the Francis method

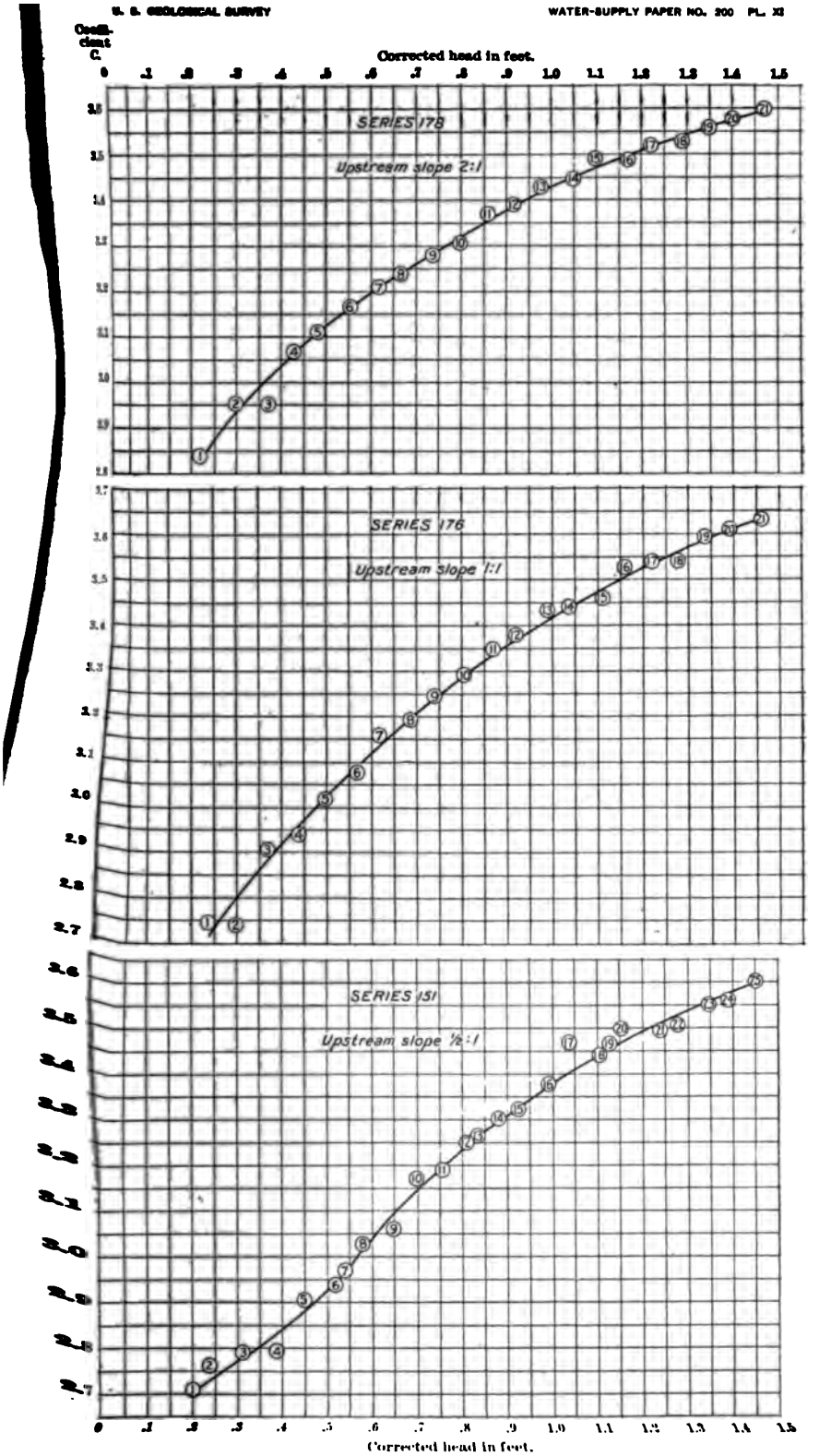


MEAN CONSTANT COEFFICIENTS FOR VARYING SLOPE OF UPSTREAM FACE.



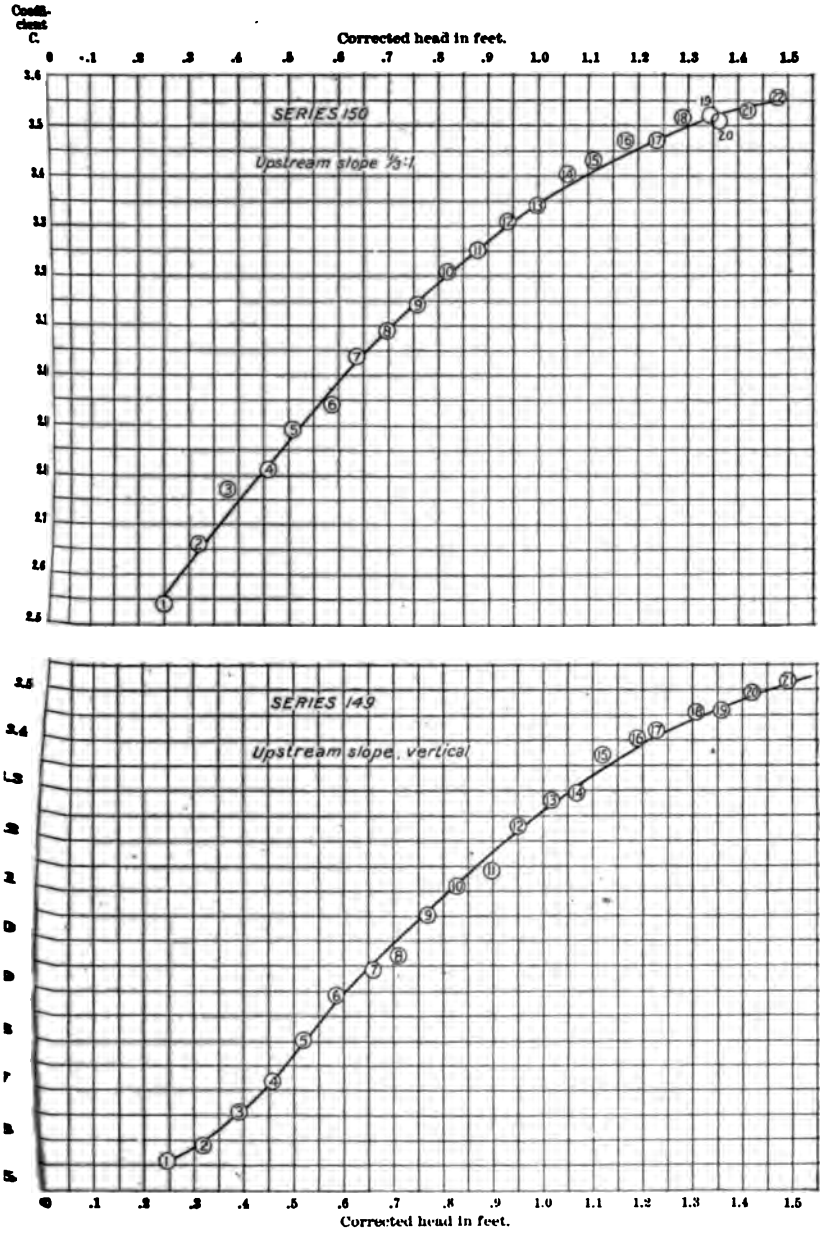
PERIMENTS OF BAZIN ON WEIRS OF TRIANGULAR SECTION WITH VARYING UPSTREAM SLOPE.

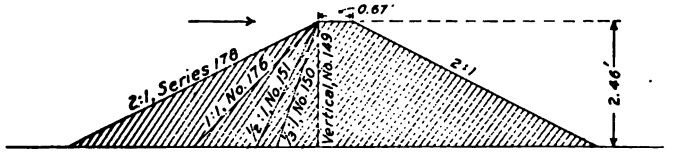
Velocity-of-approach correction by the Francis method.



EXPERIMENTS OF BAZIN ON WEIRS OF TRAPEZOIDAL SECTION WITH VARYING UPSTREAM SLOPE.

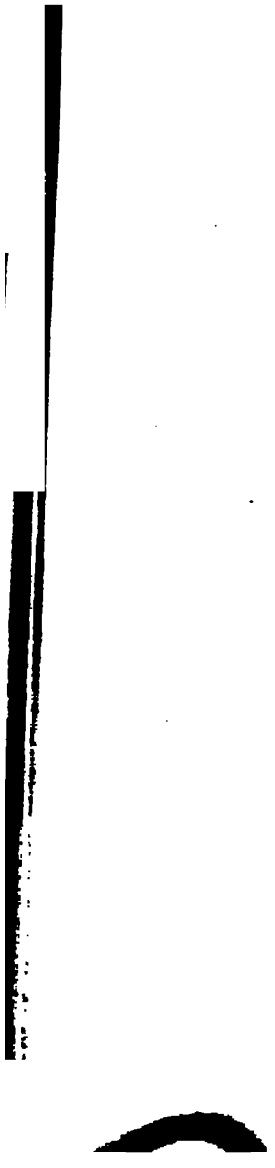
Velocity-of-approach correction by the Francis method. (For cross section see Pl. XII.)





EXPERIMENTS OF BAZIN ON WEIRS OF TRAPEZOIDAL SECTION WITH VARYING UPSTREAM SLOPE.

Velocity-of-approach correction by the Francis method. (See also Pl. XI.)



in which there is velocity of approach we may apply the correction formula of Francis,

$$H=\left[(D+h)^{\frac{3}{2}}-h^{\frac{3}{2}}\right]^{\frac{2}{3}}.$$

A sufficient approximation to this formula for our present purposes may be obtained if we simply make

$$H=D+\frac{v^2}{2g},$$

where v is the velocity of approach corresponding to the trial discharge for the head D, no successive approximations being made, as would be necessary to determine the true head H by the Francis correction formula.

For example, in an extreme case, using a thin-edged weir

$$D=1.0,\quad P=1.0,\quad v\text{ (approx.)}=\frac{Q}{P+D}=\frac{3.33}{2}=1.665$$

$$h=\frac{v^2}{2g}=0.0431\quad\text{whence}\quad H=D+\frac{v^2}{2g}=1.0431,$$

and $Q=3.547$.

By the Francis correction formula we find, using three successive approximations,

$$Q_1=3.5183 \text{ giving } v=1.7591$$
$$Q_2=3.5387 \text{ giving } v=1.7694$$
$$Q_3=3.541 \text{ as the final discharge,}$$

that the difference is 0.11 of 1 per cent. We are therefore justified in using this method to determine values of C to two places decimals, or to within one-fourth to one-half per cent.

We have also used $\sqrt{2g}=8.02$, as in the reduction of the Cornell experiments.

Column 8 gives the corrected head,

$$H=D+h.$$

Column 10 gives the final coefficient C deduced by the formula

$$C=\frac{Q}{H^{\frac{3}{2}}}.$$

Pls. IV to XII show the resulting discharge coefficients.

Bazin's experiments on weirs of irregular section.

Bazin's Series, No. 86.
Crest length, 6.55 feet.
Crest height, 2.46 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.1820	0.0777	2.7829	0.2160	0.062	.....	0.1820	0.0777	2.78
2	.2119	.0976	2.8712	.2801	.105	.....	.2119	.0976	2.87
3	.2509	.1257	2.9674	.3733	.138	.....	.2509	.1257	2.97
4	.2781	.1466	2.9754	.4369	.159	.....	.2781	.1466	2.98
5	.3067	.1701	3.0957	.5273	.190	0.0006	.3073	.1701	3.10
6	.3392	.1974	3.0957	.6119	.218	.0008	.3400	.1983	3.09
7	.3678	.2232	3.1839	.7098	.251	.0010	.3688	.2241	3.17
8	.4016	.2549	3.2321	.8233	.288	.0013	.4029	.2539	3.24
9	.4251	.2771	3.2641	.9033	.303	.0014	.4265	.2786	3.24
10	.4527	.3049	3.3283	1.0153	.350	.0019	.4546	.3069	3.31
11	.4770	.3294	3.3844	1.1137	.379	.0022	.4792	.3315	3.36
12	.5075	.3616	3.4406	1.2449	.420	.0027	.5102	.3642	3.42
13	.5360	.3924	3.4807	1.3656	.455	.0033	.5393	.3957	3.45
14	.5639	.4235	3.5368	1.4992	.496	.0039	.5678	.4280	3.50
15	.5973	.4613	3.5930	1.6561	.542	.0045	.6018	.4671	3.54
16	a.5304	.3858	3.4566	1.3349	.446	.0031	.5335	.3897	3.42
17	a.6032	.4683	3.4486	1.6156	.528	.0044	.6076	.4740	3.41
18	a.6347	.5060	3.4646	1.7508	.566	.0051	.6398	.5120	3.42

Bazin's Series, No. 89.
Crest length, 6.55 feet.
Crest height, 2.46 feet.

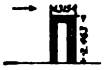
Cross section.

1	0.2079	0.0948	2.7669	0.2626	0.098	.....	0.2079	0.0948	2.77
2	.2873	.1538	2.7669	.4260	.155	.....	.2873	.1538	2.77
3	.3641	.2196	2.7669	.6083	.216	0.0008	.3649	.2205	2.76
4	.4337	.2859	2.8230	.8062	.279	.0012	.4349	.2869	2.81
5	.4963	.3494	2.8792	1.0063	.340	.0018	.4981	.3515	2.86
6	.5619	.4213	2.9674	1.2513	.414	.0026	.5635	.4235	2.95
7	.6331	.5036	3.0476	1.5360	.498	.0039	.6370	.5084	3.02
8	.6890	.57195	3.0877	1.7673	.560	.0049	.6939	.5782	3.06
9	.7490	.6482	3.1679	2.0548	.640	.0064	.7554	.6561	3.13
10	.7985	.7135	3.2160	2.2975	.705	.0078	.8063	.7236	3.18
11	.8546	.7906	3.2962	2.6090	.785	.0097	.8643	.8031	3.25
12	.9228	.8867	3.3524	2.9704	.879	.0120	.9348	.9041	3.28
13	.9648	.9479	3.4326	3.2513	.949	.0140	.9788	.9687	3.36
14	1.0236	1.0362	3.4887	3.6163	1.038	.0168	1.0404	1.0606	3.41
15	1.0784	1.1193	3.5288	3.9511	1.118	.0195	1.0979	1.1505	3.43
16	1.1312	1.2028	3.5849	4.3060	1.201	.0224	1.1536	1.2396	3.47
17	1.1866	1.2932	3.6331	4.6943	1.292	.0259	1.2125	1.3359	3.51
18	1.2375	1.3767	3.6732	5.0525	1.364	.0288	1.2663	1.4245	3.54
19	1.2959	1.4754	3.7052	5.4737	1.456	.0331	1.3290	1.5321	3.57
20	a1.0807	1.1239	3.5368	3.9786	1.122	.0195	1.1002	1.1537	3.45
21	a1.1587	1.2477	3.5448	4.4169	1.219	.0231	1.1818	1.2850	3.44

a Nappe free from the crest.

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 113.
Crest height, 2.463 feet.



Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.208	0.0948	2.64	0.2503	.....	.....	0.208	0.09484	2.63
2	.289	.1554	2.66	.4134	.....	.....	.289	.1562	2.65
3	.363	.2187	2.66	.5817	0.206	0.0007	.3637	.2196	2.65
4	.443	.2949	2.65	.7815	.269	.0011	.4441	.296	2.64
5	.518	.3728	2.66	.9916	.332	.0017	.5197	.375	2.64
6	.592	.4555	2.64	1.2025	.392	.0024	.5944	.4578	2.63
7	.667	.5447	2.71	1.4761	.472	.0034	.6704	.549	2.69
8	.736	.6314	2.75	1.7364	.542	.0045	.7405	.6377	2.72
9	.805	.7223	2.78	2.0080	.612	.0058	.8108	.7303	2.75
10	.863	.8017	2.80	2.2441	.672	.0070	.8700	.8115	2.77
11	.936	.9056	2.85	2.5810	.758	.0090	.9450	.91865	2.81
12	.989	.9835	2.88	2.8325	.821	.0105	.9995	.9925	2.84
13	1.055	1.0530	2.91	3.0641	.872	.0118	1.0468	1.068	2.86
14	1.076	1.1162	2.94	3.2816	.925	.0132	1.0892	1.1364	2.88
15	1.114	1.1758	2.95	3.4686	.968	.0143	1.1283	1.1980	2.88
16	1.159	1.2478	3.00	3.7434	1.032	.0165	1.1755	1.274	2.93
17	1.197	1.3096	3.01	3.9419	1.075	.0179	1.2149	1.339	2.94
18	1.252	1.4009	3.06	4.2868	1.154	.0206	1.2726	1.436	2.98
19	1.320	1.5166	3.11	4.7166	1.246	.0243	1.3443	1.558	3.03

Bazin's Series, No. 114.
Crest height, 2.46 feet.

Cross section.

1	0.204	0.0921	2.47	0.2275	0.056	.....	0.204	0.0921	2.47
2	.280	.1482	2.54	.3764	.137	.....	.280	.1482	2.54
3	.352	.2089	2.59	.5411	.193	0.0006	.3526	.2097	2.58
4	.433	.28497	2.60	.7409	.256	.0011	.4341	.2860	2.59
5	.504	.3578	2.59	.9267	.313	.0015	.5055	.3594	2.58
6	.578	.4394	2.60	1.1424	.376	.0022	.5802	.4417	2.59
7	.657	.5325	2.62	1.3952	.446	.0031	.6601	.5362	2.60
8	.735	.6302	2.63	1.6511	.517	.0042	.7392	.6353	2.59
9	.810	.7290	2.63	1.9173	.587	.0054	.8154	.7358	2.60
10	.882	.8283	2.65	2.1950	.655	.0068	.8888	.8381	2.62
11	.958	.9377	2.66	2.4943	.728	.0083	.9663	.9494	2.63
12	1.034	1.0514	2.68	2.8178	.806	.0102	1.0442	1.0667	2.64
13	1.112	1.1727	2.69	3.1546	.883	.0120	1.1240	1.1917	2.65
14	1.171	1.2672	2.70	3.4214	.941	.0137	1.1847	1.2899	2.65
15	1.243	1.3858	2.73	3.7832	1.021	.0161	1.2591	1.4127	2.67
16	1.301	1.4839	2.73	4.0510	1.078	.0181	1.3191	1.5149	2.66
17	1.384	1.6282	2.76	4.4938	1.168	.0213	1.4053	1.6654	2.70

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 115.
Crest height, 2.46 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.196	0.0868	2.25	0.1953	0.073	.....	0.196	0.0868	2.25
2	.264	.1357	2.41	.3270	.120	.....	.264	.1357	2.41
3	.342	.2001	2.45	.4902	.175	0.0005	.3425	.2005	2.44
4	.415	.2674	2.51	.6712	.233	.0008	.4158	.2683	2.50
5	.495	.3483	2.50	.8708	.290	.0013	.4963	.3494	2.49
6	.566	.4258	2.55	1.0858	.358	.0020	.5680	.4281	2.54
7	.638	.5096	2.54	1.2944	.418	.0027	.6407	.5132	2.52
8	.716	.6059	2.56	1.5511	.487	.0037	.7197	.6109	2.54
9	.792	.7049	2.60	1.8327	.563	.0049	.7969	.7115	2.58
10	.871	.8129	2.60	2.1135	.634	.0062	.8782	.8227	2.57
11	.948	.9230	2.60	2.4098	.706	.0078	.9558	.9347	2.58
12	1.023	1.0347	2.61	2.7006	.775	.0095	1.0325	1.0491	2.57
13	1.097	1.1490	2.63	3.0219	.849	.0112	1.1089	1.1679	2.58
14	1.178	1.2786	2.64	3.3755	.928	.0134	1.1914	1.2997	2.59
15	1.260	1.4144	2.65	3.7482	1.009	.0159	1.276	1.4414	2.58
16	1.330	1.5338	2.68	4.1106	1.085	.0181	1.348	1.5651	2.62
17	1.388	1.6353	2.69	4.3990	1.144	.0202	1.408	1.6707	2.62
18	1.424	1.6993	2.70	4.5881	1.18	.0216	1.446	1.7388	2.64
19	1.467	1.7768	2.70	4.797	1.26	.0247	1.492	1.8225	2.63

Bazin's Series, No. 116.
Crest height, 2.46 feet.

Cross section.

1	0.177	0.0745	2.71	0.2019	0.076	.....	0.177	0.0745	2.71
2	.225	.1068	2.83	.3022	.112	.....	.225	.1068	2.83
3	.296	.1611	2.90	.4672	.169	.....	.296	.1611	2.90
4	.367	.2224	2.92	.6494	.229	0.0008	.3678	.2232	2.91
5	.435	.2870	2.95	.8467	.292	.0013	.4363	.2879	2.94
6	.504	.3578	2.98	1.0662	.360	.0020	.5060	.3599	2.96
7	.537	.3935	2.99	1.1776	.392	.0024	.5394	.3957	2.98
8	.639	.5108	3.01	1.5375	.497	.0039	.6429	.5156	2.98
9	.713	.6021	3.00	1.8063	.569	.0051	.7181	.6084	2.97
10	.781	.6902	3.00	2.0706	.640	.0064	.7874	.6982	2.96
11	.849	.7823	3.02	2.3625	.713	.0078	.8568	.7933	2.98
12	.917	.8781	3.02	2.6519	.793	.0097	.9267	.8925	2.97
13	.986	.9791	3.05	2.9863	.864	.0115	.9975	.9963	3.00
14	1.053	1.0805	3.06	3.3063	.942	.0137	1.0667	1.1021	3.00
15	1.120	1.1858	3.08	3.6507	1.019	.0162	1.1362	1.2108	3.02
16	1.185	1.28995	3.09	3.9859	1.092	.0185	1.2035	1.3203	3.02
17	1.251	1.3992	3.10	4.3375	1.169	.0213	1.2723	1.4346	3.02
18	1.317	1.5114	3.12	4.7156	1.250	.0243	1.3413	1.5529	3.04

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 117.
Crest height, 2.46 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.158	0.06282	2.19	0.1376	0.043	.....	0.158	0.0628	2.19
2	.204	.09212	2.64	.2432	.091	.....	.204	.0921	2.64
3	.289	.1554	2.57	.3994	.145	.....	.289	.1554	2.56
4	.361	.21691	2.65	.5126	.182	0.0005	.3615	.2178	2.35
5	.426	.27808	2.73	.7592	.263	.0011	.4271	.2791	2.72
6	.494	.34724	2.77	.9619	.321	.0016	.4956	.3493	2.76
7	.562	.42134	2.83	1.1924	.395	.0025	.5645	.4247	2.81
8	.635	.5060	2.82	1.4267	.461	.0033	.6383	.5096	2.80
9	.708	.59578	2.86	1.7049	.589	.0045	.7125	.6020	2.83
10	.771	.67702	2.89	1.9566	.606	.0058	.7768	.6849	2.86
11	.834	.76168	2.91	2.2155	.674	.0070	.8410	.7713	2.87
12	.912	.87096	2.93	2.5519	.758	.0090	.9210	.8839	2.89
13	.989	.98352	2.95	2.9014	.841	.0110	1.0000	1.0000	2.90
14	1.064	1.0975	2.95	3.2376	.919	.0132	1.0772	1.1177	2.90
15	1.129	1.1996	2.95	3.5388	.987	.0152	1.1442	1.2236	2.89
16	1.197	1.3096	2.97	3.8895	1.062	.0175	1.2145	1.3392	2.90
17	1.267	1.4262	2.98	4.2501	1.139	.0202	1.2872	1.4601	2.91
18	1.336	1.5442	2.99	4.6172	1.214	.0228	1.3588	1.5842	2.91

Bazin's Series, No. 136.
Crest length, 6.519 feet.
Crest height, 2.46 feet.

Cross section.

1	0.183	0.0783	3.90	0.305	0.12	0.0002	0.1832	0.0783	3.90
2	.244	.1206	3.86	.467	.17	.0004	.2444	.1206	3.87
3	.304	.1676	3.85	.647	.23	.0008	.3048	.1684	3.84
4	.364	.2196	3.86	.849	.30	.0014	.3654	.2206	3.85
5	.424	.2761	3.88	1.071	.37	.0021	.4261	.2781	3.85
6	.484	.3367	3.87	1.304	.41	.0030	.4870	.3399	3.84
7	.542	.3990	3.88	1.548	.52	.0042	.5462	.4035	3.84
8	.597	.4613	3.89	1.793	.59	.0054	.6024	.4671	3.84
9	.658	.5338	3.91	2.088	.67	.0070	.6650	.5423	3.85
10	.713	.6021	3.92	2.360	.74	.0085	.7215	.6135	3.85
11	.776	.6836	3.93	2.684	.83	.0107	.7867	.6982	3.84
12	.830	.7562	3.97	3.001	.91	.0129	.8427	.7740	3.88
13	.887	.8354	3.96	3.300	.99	.0152	.9022	.8567	3.85
14	.953	.9303	3.98	3.701	1.08	.0181	.9711	.9568	3.87
15	1.010	1.0150	3.97	4.029	1.16	.0209	1.0309	1.0468	3.85
16	1.068	1.1037	4.00	4.417	1.25	.0243	1.0923	1.1411	3.87
17	1.122	1.1885	3.99	4.748	1.33	.0275	1.1495	1.2316	3.86
18	1.179	1.2802	4.01	5.133	1.41	.0309	1.2099	1.3310	3.86
19	1.244	1.3875	4.01	5.564	1.50	.0350	1.2790	1.4446	3.85
20	1.299	1.4805	4.01	5.935	1.58	.0388	1.3378	1.5477	3.84
21	1.361	1.5878	4.03	6.408	1.68	.0439	1.4049	1.6654	3.85

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 137.
Crest length, 6.523 feet.
Crest height, 2.46 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	r	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.268	0.1388	3.47	0.482	0.18	0.0006	0.2686	0.1395	3.46
2	.332	.1974	3.45	.680	.24	.0009	.3329	.1922	3.54
3	.391	.2445	3.50	.856	.30	.0014	.3924	.2454	3.49
4	.451	.3029	3.47	1.051	.36	.0020	.4530	.3049	3.45
5	.513	.3674	3.53	1.295	.44	.0030	.5160	.3707	3.49
6	.578	.4394	3.51	1.540	.51	.0040	.5820	.4440	3.47
7	.637	.5064	3.51	1.783	.57	.0051	.6421	.5144	3.47
8	.700	.5857	3.55	2.080	.66	.0068	.7068	.5945	3.50
9	.765	.6692	3.56	2.382	.74	.0085	.7735	.6797	3.50
10	.822	.7452	3.56	2.652	.81	.0102	.8322	.7589	3.49
11	.887	.8354	3.56	2.973	.89	.0123	.8993	.8524	3.49
12	.946	.9201	3.62	3.334	.98	.0149	.9609	.9420	3.54
13	1.012	1.0180	3.59	3.662	1.05	.0171	1.0291	1.0438	3.51
14	1.078	1.1193	3.61	4.043	1.14	.0202	1.0982	1.1506	3.51
15	1.142	1.2204	3.60	4.392	1.22	.0231	1.1651	1.2575	3.49
16	1.201	1.3162	3.62	4.778	1.30	.0263	1.2273	1.3591	3.52
17	1.262	1.4178	3.62	5.140	1.38	.0296	1.2916	1.4686	3.50
18	1.322	1.5200	3.64	5.533	1.46	.0331	1.3561	1.5773	3.51

Bazin's Series, No. 138.
Crest length, 6.532 feet.
Crest height, 1.64 feet.

Cross section.

1	0.194	0.0854	3.57	0.305	0.17	0.0004	0.1944	0.0854	3.57
2	.263	.1349	3.50	.473	.25	.0010	.2640	.1357	3.48
3	.327	.1870	3.48	.651	.33	.0017	.3287	.1887	3.45
4	.391	.2445	3.50	.858	.42	.0027	.3937	.2473	3.47
5	.447	.2989	3.56	1.064	.50	.0039	.4519	.3039	3.50
6	.510	.3642	3.63	1.321	.61	.0058	.5158	.3706	3.56
7	.571	.4314	3.62	1.560	.70	.0076	.5786	.4405	3.54
8	.626	.4953	3.71	1.838	.81	.0102	.6362	.5072	3.62
9	.685	.5670	3.66	2.075	.89	.0123	.6973	.5820	3.56
10	.745	.6431	3.69	2.373	.99	.0152	.7602	.6626	3.58
11	.807	.7250	3.70	2.683	1.09	.0185	.8255	.7507	3.57
12	.873	.8157	3.72	3.036	1.21	.0228	.8958	.8481	3.58
13	.927	.8926	3.72	3.318	1.29	.0259	.9529	.9303	3.56
14	.992	.9880	3.76	3.715	1.41	.0309	1.0229	1.0347	3.59
15	1.045	1.0683	3.80	4.060	1.51	.0354	1.0804	1.1224	3.62
16	1.110	1.1695	3.78	4.422	1.61	.0403	1.1503	1.2332	3.58
17	1.176	1.2753	3.79	4.851	1.72	.0460	1.2220	1.3508	3.59
18	1.233	1.3691	3.81	5.220	1.82	.0515	1.2845	1.4550	3.59
19	1.289	1.4645	3.82	5.577	1.90	.0567	1.3451	1.5599	3.58
20	1.355	1.5773	3.82	6.036	2.01	.0628	1.4178	1.6865	3.57
21	1.429	1.7082	3.83	6.542	2.13	.0705	1.4995	1.8362	3.56

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 145.
Crest length, 6.541 feet.
Crest height, 1.64 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	r	$\frac{r^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.359	0.2151	3.02	0.649	0.32	0.0016	0.3606	0.2169	2.99
2	.424	.2761	3.10	.856	.42	.0027	.4267	.2790	3.07
3	.479	.3315	3.18	1.053	.50	.0039	.4869	.3335	3.16
4	.547	.4046	3.25	1.316	.60	.0056	.5526	.4112	3.20
5	.592	.4636	3.35	1.553	.69	.0074	.5994	.4636	3.33
6	.658	.5238	3.38	1.805	.78	.0095	.6675	.5447	3.31
7	.720	.6109	3.42	2.090	.89	.0123	.7323	.6263	3.34
8	.781	.6902	3.47	2.394	.99	.0152	.7962	.7102	3.37
9	.835	.7631	3.49	2.663	1.07	.0178	.8528	.7878	3.38
10	.902	.8567	3.53	3.025	1.19	.0220	.9240	.8882	3.41
11	.962	.9435	3.53	3.332	1.28	.0255	.9875	.9806	3.40
12	1.082	1.0484	3.53	3.707	1.39	.0300	1.0630	1.0944	3.39
13	1.087	1.1333	3.56	4.045	1.48	.0341	1.1211	1.1869	3.41
14	1.152	1.2364	3.56	4.403	1.58	.0388	1.1908	1.2997	3.39
15	1.210	1.3310	3.61	4.801	1.68	.0439	1.2539	1.4042	3.42
16	1.274	1.4380	3.61	5.198	1.78	.0493	1.3233	1.5218	3.42
17	1.334	1.5406	3.62	5.575	1.88	.0549	1.3889	1.6370	3.40
18	1.396	1.6494	3.64	6.006	1.98	.0609	1.4569	1.7586	3.42
19	1.467	1.7768	3.64	6.479	2.09	.0679	1.5349	1.9016	3.41

Bazin's Series, No. 141.
Crest length, 6.520 feet.
Crest height, 2.46 feet.

Cross section.

1	0.215	0.0997	3.02	0.301	0.11	0.0002	0.2152	0.0997	3.02
2	.281	.1490	3.09	.460	.17	.0004	.2814	.1490	3.09
3	.355	.2116	3.07	.650	.24	.0009	.3559	.2124	3.06
4	.425	.2771	3.04	.842	.29	.0013	.4263	.2781	3.02
5	.489	.3420	3.08	1.053	.37	.0021	.4911	.3441	3.06
6	.561	.4202	3.08	1.294	.43	.0029	.5639	.4235	3.06
7	.624	.4929	3.17	1.562	.51	.0040	.6280	.4976	3.14
8	.692	.5757	3.11	1.791	.57	.0051	.6971	.5820	3.08
9	.758	.6600	3.12	2.059	.64	.0064	.7644	.6678	3.08
10	.822	.7452	3.15	2.347	.72	.0081	.8301	.7562	3.10
11	.888	.8368	3.17	2.653	.79	.0097	.8977	.8509	3.12
12	.956	.9347	3.19	2.983	.87	.0118	.9678	.9523	3.13
13	1.029	1.0438	3.17	3.309	.95	.0140	1.0430	1.0652	3.12
14	1.113	1.1742	3.20	3.757	1.04	.0168	1.1298	1.2012	3.13
15	1.165	1.2575	3.21	4.045	1.12	.0195	1.1845	1.2884	3.14
16	1.237	1.3758	3.20	4.416	1.19	.0220	1.2590	1.4127	3.13
17	1.298	1.4788	3.22	4.766	1.27	.0251	1.3231	1.5218	3.13
18	1.369	1.6018	3.22	5.152	1.34	.0279	1.3969	1.6511	3.12
19	1.431	1.7118	3.24	5.540	1.42	.0313	1.4623	1.7677	3.13
20	1.463	1.7696	3.25	5.752	1.47	.0336	1.4966	1.8307	3.14

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 142.
Crest length, 6.523 feet.
Crest height, 2.46 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$
1	2	3	4	5	6	7	8	9
1	0.300	0.1643	2.83	0.464	0.17	0.0004	0.3004	0.1643
2	.369	.2242	2.87	.643	.23	.0008	.3698	.2251
3	.447	.2989	2.87	.851	.29	.0013	.4483	.2999
4	.509	.3631	2.86	1.038	.35	.0019	.5109	.3652
5	.591	.4544	2.88	1.306	.43	.0029	.5939	.4578
6	.656	.5435	2.86	1.554	.50	.0039	.6699	.5484
7	.727	.6199	2.92	1.810	.57	.0051	.7327	.6263
8	.795	.7089	2.94	2.084	.64	.0064	.8014	.7155
9	.861	.7989	2.94	2.349	.71	.0078	.8688	.8101
10	.934	.9027	2.95	2.664	.78	.0095	.9435	.9156
11	1.007	1.0105	2.95	2.980	.86	.0115	1.0185	1.0296
12	1.079	1.1208	2.98	3.338	.94	.0137	1.0927	1.1427
13	1.149	1.2316	2.98	3.665	1.01	.0159	1.1649	1.2575
14	1.222	1.3508	2.99	4.037	1.10	.0188	1.2408	1.3824
15	1.285	1.4567	3.00	4.370	1.17	.0213	1.3063	1.4925
16	1.362	1.5885	3.00	4.770	1.25	.0243	1.3863	1.6317
17	1.430	1.7100	3.01	5.147	1.30	.0263	1.4563	1.7569

Bazin's Series, No. 139.
Crest length, 6.532 feet.
Crest height, 1.64 feet.

Cross section.

1	0.199	0.0825	3.06	0.305	0.17	0.0004	0.1994	0.0825
2	.253	.1273	3.09	.467	.25	.0009	.2549	.1290
3	.312	.1745	3.12	.647	.33	.0017	.3137	.1759
4	.373	.2267	3.06	.842	.42	.0027	.3777	.2323
5	.434	.2868	3.13	1.067	.52	.0042	.4382	.2909
6	.500	.3536	3.12	1.317	.62	.0060	.5060	.3600
7	.562	.4181	3.13	1.559	.72	.0081	.5701	.4291
8	.623	.4833	3.13	1.812	.84	.0109	.6339	.4941
9	.687	.5447	3.12	2.061	.96	.0143	.7013	.5607
10	.755	.6179	3.14	2.350	1.10	.0188	.7738	.6325
11	.796	.7129	3.20	2.708	1.23	.0235	.8195	.7365
12	.852	.7863	3.24	2.922	1.33	.0275	.8795	.8138
13	.913	.8702	3.26	3.279	1.42	.0313	.9443	.9015
14	.968	.9508	3.27	3.592	1.51	.0355	.9980	.9863
15	1.023	1.0347	3.32	3.899	1.61	.0403	1.0633	1.0750
16	1.082	1.1411	3.38	4.305	1.73	.0465	1.1285	1.1876
17	1.132	1.2346	3.42	4.659	1.84	.0526	1.1846	1.2872
18	1.200	1.3579	3.46	5.101	1.97	.0603	1.2603	1.4234
19	1.266	1.4830	3.48	5.570	2.12	.0699	1.3299	1.5698
20	1.333	1.6129	3.48	6.053	2.28	.0808	1.4108	1.7298
21	1.398	1.7460	3.48	6.554	2.43	.0918	1.4898	1.8974

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 140.
Crest length, 6.532 feet.
Crest height, 1.64 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	ω	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.192	0.0835	3.77	0.315	0.17	0.0004	0.1924	0.0841	3.74
2	.252	.1265	3.74	.473	.25	.0010	.2530	.1273	3.72
3	.308	.1709	3.75	.641	.33	.0017	.3097	.1726	3.71
4	.371	.2260	3.71	.838	.42	.0027	.3727	.2278	3.68
5	.436	.2879	3.77	1.086	.52	.0042	.4402	.2919	3.72
6	.488	.3399	3.74	1.276	.60	.0056	.4936	.3472	3.66
7	.549	.4068	3.81	1.551	.71	.0078	.5568	.4157	3.73
8	.604	.4694	3.82	1.792	.80	.0099	.6139	.4811	3.72
9	.664	.5411	3.83	2.072	.90	.0126	.6766	.5570	3.72
10	.719	.6096	3.84	2.342	.99	.0152	.7342	.6289	3.72
11	.785	.6956	3.88	2.700	1.11	.0192	.8042	.7209	3.74
12	.837	.7658	3.88	2.968	1.20	.0224	.8594	.7961	3.73
13	.905	.8610	3.92	3.375	1.32	.0271	.9321	.8998	3.75
14	.961	.9421	3.90	3.674	1.41	.0309	.9919	.9880	3.72
15	1.023	1.0347	3.95	4.069	1.53	.0364	1.0594	1.0898	3.73
16	1.080	1.1224	3.93	4.402	1.62	.0408	1.1208	1.1869	3.71
17	1.143	1.2220	3.97	4.843	1.74	.0471	1.1901	1.2981	3.73
18	1.195	1.3063	3.96	5.187	1.83	.0521	1.2471	1.3925	3.72
19	1.254	1.4043	3.97	5.558	1.92	.0573	1.3113	1.5011	3.70
20	1.316	1.5097	3.99	6.024	2.03	.0641	1.3801	1.6211	3.72
21	1.375	1.6123	4.01	6.456	2.14	.0712	1.4462	1.7388	3.71

Bazin's Series, No. 147.
Crest length, 6.536 feet.
Crest height, 2.46 feet.

Cross section.

1	0.231	0.1110	2.75	0.306	0.11	0.0002	0.2312	0.1110	2.75
2	.308	.1709	2.85	.485	.18	.0005	.3085	.1709	2.84
3	.373	.2278	2.86	.652	.23	.0008	.3738	.2287	2.85
4	.438	.2899	2.97	.861	.30	.0014	.4394	.2909	2.96
5	.503	.3568	3.02	1.078	.37	.0021	.5051	.3589	3.00
6	.569	.4292	3.13	1.343	.44	.0030	.5720	.4326	3.10
7	.637	.5084	3.20	1.626	.54	.0045	.6415	.5132	3.17
8	.681	.5620	3.24	1.821	.58	.0052	.6862	.5682	3.20
9	.734	.6289	3.34	2.109	.66	.0068	.7408	.6378	3.31
10	.797	.7115	3.40	2.417	.74	.0083	.8053	.7223	3.35
11	.845	.7768	3.44	2.673	.81	.0102	.8552	.7906	3.38
12	.898	.8510	3.53	3.004	.89	.0123	.9103	.8681	3.46
13	.953	.9303	3.57	3.320	.97	.0146	.9676	.9523	3.49
14	1.015	1.0226	3.63	3.703	1.06	.0175	1.0325	1.0484	3.53
15	1.063	1.0960	3.67	4.037	1.15	.0206	1.0836	1.1286	3.58
16	1.115	1.1774	3.73	4.401	1.22	.0231	1.1381	1.2140	3.62
17	1.165	1.2575	3.79	4.775	1.31	.0267	1.1917	1.3013	3.67
18	1.217	1.3426	3.83	5.132	1.40	.0305	1.2475	1.3925	3.68
19	1.265	1.4228	3.85	5.467	1.47	.0336	1.2986	1.4805	3.70
20	1.332	1.5373	3.89	5.991	1.58	.0388	1.3708	1.6053	3.73
21	1.394	1.6459	3.98	6.567	1.68	.0439	1.4379	1.7244	3.81

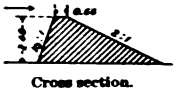
Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 149.
Crest length, 6.518 feet.
Crest height, 2.46 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	r	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.248	0.1235	2.55	0.316	0.12	0.0002	0.2482	0.1235	2.56
2	.317	.1785	2.58	.462	.17	.0004	.3174	.1785	2.59
3	.390	.2436	2.67	.651	.23	.0008	.3908	.2445	2.66
4	.455	.3070	2.73	.838	.29	.0013	.4563	.3080	2.72
5	.521	.3761	2.82	1.060	.36	.0020	.5230	.3782	2.80
6	.585	.4475	2.89	1.295	.43	.0030	.5850	.4475	2.89
7	.653	.5277	2.97	1.568	.51	.0040	.6570	.5325	2.94
8	.705	.5920	3.00	1.776	.56	.0049	.7099	.5963	2.97
9	.766	.6705	3.08	2.067	.64	.0064	.7724	.6783	3.05
10	.818	.7398	3.16	2.338	.71	.0078	.8258	.7507	3.11
11	.882	.8283	3.23	2.674	.80	.0099	.8979	.8509	3.14
12	.942	.9143	3.30	3.016	.89	.0123	.9543	.9318	3.23
13	.999	.9985	3.36	3.356	.97	.0146	1.0156	1.0241	3.28
14	1.051	1.0774	3.39	3.627	1.03	.0165	1.0665	1.1006	3.30
15	1.103	1.1584	3.45	4.002	1.12	.0196	1.1225	1.1885	3.37
16	1.165	1.2575	3.49	4.397	1.20	.0224	1.1874	1.2982	3.40
17	1.209	1.3294	3.52	4.682	1.27	.0251	1.2341	1.3706	3.42
18	1.281	1.4499	3.57	5.177	1.38	.0296	1.3106	1.5011	3.45
19	1.330	1.5338	3.60	5.508	1.45	.0327	1.3627	1.5912	3.46
20	1.385	1.6300	3.63	5.917	1.54	.0369	1.4219	1.6956	3.49
21	1.446	1.7388	3.67	6.386	1.64	.0418	1.4878	1.8151	3.52

Bazin's Series, No. 150.
Crest length, 6.518 feet.
Crest height, 2.46 feet.



Cross section.

1	0.248	0.1235	2.53	0.314	0.12	0.0002	0.2482	0.1235	2.54
2	.323	.1836	2.65	.488	.16	.0004	.3234	.1836	2.66
3	.379	.2333	2.78	.648	.23	.0008	.3798	.2342	2.77
4	.459	.3110	2.82	.877	.30	.0014	.4604	.3120	2.81
5	.512	.3664	2.91	1.065	.36	.0020	.5140	.3685	2.89
6	.586	.4486	2.96	1.329	.43	.0029	.5889	.4521	2.94
7	.637	.5084	3.07	1.560	.50	.0039	.6409	.5132	3.04
8	.698	.5832	3.12	1.819	.57	.0051	.7031	.5895	3.09
9	.751	.6508	3.18	2.070	.64	.0064	.7574	.6587	3.14
10	.814	.7344	3.26	2.393	.73	.0083	.8223	.7452	3.21
11	.869	.8101	3.31	2.681	.80	.0099	.8789	.8241	3.25
12	.928	.8940	3.37	3.013	.89	.0123	.9403	.9114	3.31
13	.982	.9732	3.42	3.328	.97	.0146	.9966	.9955	3.34
14	1.043	1.0652	3.47	3.713	1.06	.0175	1.0605	1.0913	3.40
15	1.095	1.1459	3.51	4.037	1.13	.0199	1.1149	1.1774	3.43
16	1.152	1.2364	3.56	4.414	1.22	.0231	1.1751	1.2737	3.46
17	1.215	1.3393	3.58	4.797	1.30	.0263	1.2413	1.3825	3.47
18	1.259	1.4127	3.63	5.118	1.38	.0296	1.2856	1.4584	3.51
[illegible]	1.315	1.5080	3.65	5.512	1.46	.0331	1.3481	1.5651	3.52
[illegible]	[illegible]	1.5218	3.65	5.548	1.47	.0336	1.3566	1.5807	3.51
		1.6211	3.68	5.962	1.55	.0374	1.4174	1.6868	3.54
		7282	3.73	6.416	1.64	.0418	1.4878	1.8023	3.56

Bazin's experiments on weirs of irregular section—Continued.

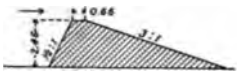
Bazin's Series, No. 151.
Crest length, 6.550 feet.
Crest height, 2.46 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	r	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.201	0.0901	2.71	0.244	0.09	0.0001	0.2011	0.0901	2.71
2	.240	.1176	2.81	.329	.12	.0002	.2422	.1191	2.76
3	.307	.1701	2.79	.474	.17	.0004	.3074	.1701	2.79
4	.391	.2445	2.79	.684	.24	.0009	.3919	.2454	2.79
5	.445	.2969	2.92	.867	.30	.0014	.4464	.2979	2.91
6	.514	.3685	2.95	1.089	.37	.0021	.5161	.3707	2.94
7	.537	.3935	2.98	1.174	.39	.0024	.5394	.3957	2.97
8	.573	.4337	3.05	1.324	.43	.0030	.5760	.4371	3.03
9	.643	.5156	3.09	1.594	.51	.0040	.6470	.5204	3.06
10	.695	.5795	3.20	1.856	.59	.0054	.7004	.5857	3.17
11	.756	.6574	3.24	2.129	.66	.0068	.7628	.6665	3.19
12	.800	.7155	3.30	2.362	.72	.0081	.8081	.7263	3.25
13	.826	.7507	3.31	2.486	.76	.0090	.8350	.7631	3.26
14	.867	.8073	3.36	2.712	.81	.0102	.8772	.8213	3.30
15	.921	.8839	3.39	2.997	.89	.0123	.9333	.9013	3.32
16	.975	.9628	3.46	3.332	.97	.0146	.9896	.9850	3.38
17	1.027	1.0408	3.51	3.653	1.04	.0168	1.0438	1.0667	3.47
18	1.090	1.1380	3.52	4.013	1.13	.0199	1.1099	1.1695	3.43
19	1.112	1.1727	3.57	4.177	1.17	.0215	1.1333	1.2000	3.46
20	1.140	1.2172	3.60	4.382	1.22	.0231	1.1631	1.2543	3.50
21	1.209	1.3294	3.61	4.801	1.31	.0267	1.2357	1.3741	3.49
22	1.248	1.3942	3.64	5.060	1.36	.0288	1.2768	1.4431	3.51
23	1.314	1.5063	3.68	5.557	1.47	.0336	1.3476	1.5651	3.55
24	1.352	1.5721	3.71	6.825	1.52	0359	1.3879	1.6352	3.56
25	1.416	1.6850	3.75	6.337	1.64	.0418	1.4578	1.7604	3.60

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 153.
Crest length, 6.515 feet.
Crest height, 2.46 feet.



Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.237	0.1154	2.73	0.314	0.12	0.0002	0.2372	0.1154	2.72
2	.301	.1651	2.77	.457	.16	.0004	.3014	.1651	2.77
3	.372	.2269	2.79	.633	.22	.0008	.3728	.2278	2.78
4	.373	.2278	2.83	.645	.23	.0008	.3738	.2287	2.82
5	.440	.2919	2.90	.847	.29	.0013	.4413	.2929	2.89
6	.505	.3589	2.93	1.052	.35	.0019	.5069	.3610	2.91
7	.576	.4371	3.00	1.311	.43	.0030	.5790	.4406	2.98
8	.637	.5084	3.07	1.560	.50	.0039	.6409	.5132	3.04
9	.696	.5807	3.10	1.801	.57	.0051	.7011	.5870	3.07
10	.701	.5870	3.10	1.820	.58	.0052	.7062	.5933	3.07
11	.760	.6626	3.15	2.085	.65	.0066	.7666	.6717	3.10
12	.762	.6652	3.16	2.101	.65	.0066	.7686	.6743	3.12
13	.814	.7344	3.20	2.349	.72	.0081	.8221	.7452	3.15
14	.879	.8241	3.25	2.678	.80	.0099	.8889	.8381	3.20
15	.937	.9071	3.29	2.984	.88	.0120	.9490	.9245	3.23
16	.993	.9895	3.34	3.307	.96	.0143	1.0073	1.0105	3.27
17	1.001	1.0015	3.33	3.330	.96	.0143	1.0158	1.0226	3.26
18	1.055	1.0836	3.40	3.672	1.05	.0171	1.0721	1.1099	3.31
19	1.102	1.1569	3.41	3.956	1.11	.0192	1.1212	1.1869	3.33
20	1.170	1.2656	3.46	4.394	1.21	.0228	1.1928	1.3030	3.37
21	1.226	1.3575	3.48	4.733	1.28	.0255	1.2515	1.3992	3.38
22	1.290	1.4652	3.51	5.159	1.38	.0296	1.3196	1.5166	3.40
23	1.289	1.4635	3.52	5.139	1.37	.0292	1.3182	1.5132	3.40
24	1.347	1.5634	3.53	5.507	1.45	.0327	1.3791	1.6193	3.40
25	1.404	1.6636	3.58	5.943	1.54	.0369	1.4409	1.7298	3.44
26	1.436	1.7208	3.58	6.158	1.58	.0388	1.4748	1.7914	3.44

Bazin's experiments on weirs of irregular section—Continued.

Series. No. 154.
ngth, 6.516 feet.
eight, 2.46 feet.

Cross section.

Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
2	3	4	5	6	7	8	9	10
0.236	0.1147	2.70	0.311	0.12	0.0002	0.2632	0.1349	2.30
.308	.1709	2.74	.469	.17	.0004	.3084	.1709	2.74
.373	.2278	2.83	.645	.23	.0008	.3738	.2287	2.82
.447	.2989	2.85	.852	.29	.0013	.4483	.2999	2.84
.508	.3621	2.95	1.068	.36	.0020	.5100	.3642	2.94
.577	.4382	2.97	1.301	.37	.0021	.5791	.4406	2.95
.643	.5156	3.04	1.569	.51	.0040	.6470	.5204	3.02
.706	.5933	3.07	1.821	.57	.0051	.7111	.5996	3.04
.760	.6626	3.17	2.102	.65	.0066	.7666	.6717	3.11
.823	.7466	3.20	2.389	.73	.0083	.8313	.7576	3.16
.888	.8368	3.20	2.678	.80	.0099	.8979	.8509	3.15
.946	.9201	3.24	2.981	.87	.0118	.9578	.9376	3.18
1.011	1.0165	3.28	3.334	.96	.0143	1.0253	1.0377	3.21
1.075	1.1146	3.31	3.674	1.03	.0165	1.0915	1.1396	3.22
1.138	1.2140	3.36	4.066	1.13	.0199	1.1579	1.2461	3.26
1.195	1.3063	3.37	4.415	1.20	.0224	1.2174	1.3426	3.29
1.250	1.3975	3.40	4.760	1.28	.0255	1.2755	1.4397	3.31
1.310	1.4994	3.43	5.145	1.36	.0288	1.3388	1.5494	3.32
1.370	1.6035	3.45	5.520	1.44	.0322	1.4022	1.6601	3.32
1.430	1.7100	3.48	5.951	1.53	.0364	1.4664	1.7750	3.35

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 156.
Crest height, 2.46 feet.
Crest width, 0.66 foot.
Upstream slope, ¼ to 1.
Downstream slope, 5 to 1.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.246	0.1220	2.76	0.337	0.12	0.0002	0.2462	0.1220	2.76
2	.311	.1734	2.80	.486	.17	.0004	.3114	.1734	2.80
3	.382	.2361	2.84	.671	.24	.0009	.3829	.2370	2.83
4	.446	.2979	2.90	.864	.30	.0014	.4474	.2989	2.89
5	.508	.3621	2.91	1.054	.36	.0020	.5100	.3642	2.89
6	.576	.4371	2.95	1.289	.42	.0027	.5787	.4406	2.92
7	.638	.5096	3.01	1.534	.49	.0037	.6417	.5144	2.98
8	.703	.5895	3.06	1.804	.57	.0051	.7081	.5958	3.03
9	.764	.6678	3.10	2.070	.64	.0064	.7704	.6757	3.06
10	.834	.7617	3.13	2.384	.72	.0081	.8421	.7727	3.08
11	.888	.8368	3.17	2.653	.79	.0097	.8977	.8510	3.12
12	.956	.9347	3.24	3.028	.88	.0120	.9680	.9524	3.18
13	1.018	1.0272	3.22	3.309	.95	.0140	1.0320	1.0484	3.16
14	1.074	1.1130	3.30	3.673	1.04	.0168	1.0908	1.1396	3.22
15	1.139	1.2156	3.29	3.999	1.11	.0192	1.1582	1.2462	3.21
16	1.203	1.3194	3.31	4.367	1.19	.0220	1.2250	1.3558	3.22
17	1.267	1.4262	3.34	4.764	1.26	.0247	1.2917	1.4686	3.24
18	1.341	1.5529	3.36	5.218	1.37	.0292	1.3702	1.6035	3.25
19	1.394	1.6459	3.36	5.530	1.43	.0318	1.4258	1.7028	3.25
20	1.457	1.7587	3.39	5.962	1.52	.0359	1.4929	1.8241	3.27

Bazin's Series, No. 158.
Crest length, 6.520 feet.
Crest height, 2.46 feet.

Cross section.

1	0.234	0.1132	2.79	0.316	0.12	0.0002	0.2342	0.1132	2.79
2	.312	.1743	2.72	.474	.17	.0004	.3124	.1743	2.72
3	.383	.2370	2.77	.656	.23	.0008	.3838	.2379	2.76
4	.457	.3090	2.79	.862	.29	.0013	.4583	.3100	2.78
5	.530	.3858	2.81	1.085	.36	.0020	.5320	.3880	2.80
6	.600	.4648	2.82	1.311	.43	.0030	.6030	.4683	2.80
7	.672	.5509	2.86	1.576	.50	.0039	.6759	.5557	2.84
8	.733	.6276	2.90	1.821	.57	.0051	.7381	.6340	2.87
9	.799	.7142	2.91	2.078	.64	.0064	.8054	.7223	2.88
10	.860	.7975	2.95	2.354	.71	.0078	.8678	.8087	2.91
11	.930	.8969	3.00	2.691	.79	.0097	.9397	.9114	2.95
12	.984	.9761	3.04	2.967	.86	.0115	.9955	.9925	2.99
13	1.055	1.0836	3.10	3.348	.95	.0140	1.0690	1.1053	3.03
14	1.125	1.1933	3.12	3.713	1.04	.0168	1.1418	1.2204	3.04
15	1.177	1.2769	3.15	4.022	1.10	.0188	1.1958	1.3029	3.08
16	1.243	1.3858	3.19	4.434	1.20	.0224	1.2654	1.4228	3.12
17	1.297	1.4771	3.22	4.766	1.27	.0251	1.3221	1.5200	3.14
18	1.361	1.5878	3.25	5.168	1.35	.0283	1.3893	1.6370	3.16
19	1.412	1.6779	3.30	5.544	1.43	.0318	1.4468	1.7406	3.18
20	1.457	1.7587	3.32	5.839	1.49	.0345	1.4915	1.8215	3.22

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 159.
Crest length, 6.511 feet.
Crest height, 2.46 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.234	0.1132	2.68	0.303	0.11	0.0002	0.2342	0.1132	2.68
2	.304	.1676	2.75	.462	.17	.0004	.3044	.1676	2.74
3	.379	.2333	2.82	.657	.23	.0008	.3798	.2342	2.80
4	.387	.2408	2.82	.680	.24	.0009	.3879	.2417	2.81
5	.457	.3090	2.81	.868	.30	.0014	.4584	.3100	2.80
6	.516	.3707	2.91	1.079	.36	.0020	.5180	.3728	2.89
7	.526	.3815	2.84	1.085	.36	.0020	.5280	.3836	2.83
8	.599	.4636	2.82	1.308	.43	.0030	.6020	.4671	2.81
9	.664	.5411	2.87	1.553	.50	.0039	.6679	.5160	2.84
10	.670	.5484	2.83	1.552	.49	.0037	.6737	.5533	2.80
11	.735	.6302	2.88	1.813	.56	.0049	.7399	.6366	2.85
12	.797	.7115	2.94	2.092	.64	.0064	.8034	.7196	2.91
13	.861	.7989	2.99	2.389	.72	.0081	.8693	.8101	2.95
14	.876	.8199	2.94	2.411	.72	.0081	.8843	.8311	2.90
15	.935	.9042	2.93	2.649	.78	.0095	.9445	.9172	2.89
16	.994	.9910	3.01	2.983	.86	.0115	1.0055	1.009	2.96
17	1.068	1.1037	3.03	3.333	.94	.0137	1.0817	1.1255	2.96
18	1.126	1.1948	3.10	3.704	1.03	.0165	1.1425	1.2204	3.04
19	1.145	1.2252	3.05	3.751	1.04	.0168	1.1618	1.2526	3.00
20	1.198	1.3112	3.08	4.035	1.10	.0188	1.2168	1.3425	3.00
21	1.261	1.4161	3.11	4.416	1.19	.0220	1.2830	1.4533	3.03
22	1.320	1.5166	3.15	4.777	1.27	.0251	1 3451	1.5599	3.06
23	1.332	1.5373	3.13	4.820	1.27	.0251	1.3571	1.5808	3.05
24	1.389	1.6370	3.14	5.150	1.33	.0275	1.4165	1.6850	3.06
25	1.445	1.7370	3.19	5.551	1.42	.0313	1.4763	1.7932	3.09
26	1.456	1.7569	3.19	5.614	1.43	.0348	1.4908	1.8188	3.09

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 160.
Crest height, 2.46 feet.
Crest width, 1.31 feet.
Upstream slope, ½ to 1.
Downstream slope, 6 to **1.**

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.451	0.3029	2.81	0.8540	0.29	0.0013	0.4523	0.3039	2.80
2	.522	.3772	2.82	1.0637	.36	.0020	.5240	.3793	2.80
3	.593	.4567	2.84	1.2970	.42	.0027	.5957	.4601	2.82
4	.663	.5399	2.88	1.5549	.50	.0039	.6669	.5447	2.86
5	.735	.6302	2.89	1.8213	.57	.0051	.7401	.6366	2.86
6	.798	.7128	2.91	2.0742	.64	.0064	.8044	.7209	2.88
7	.863	.8017	2.92	2.3410	.70	.0076	.8706	.8129	2.88
8	.930	.8969	2.97	2.6638	.78	.0095	.9395	.9100	2.93
9	.998	.9970	2.99	2.9810	.86	.0115	1.0095	1.0135	2.94
10	1.074	1.1130	3.02	3.3361	.95	.0140	1.0880	1.1349	2.94
11	1.129	1.1996	3.03	3.6348	1.01	.0159	1.1449	1.2252	2.97
12	1.193	1.3030	3.06	3.9872	1.09	.0185	1.2115	1.3334	2.98
13	1.254	1.4043	3.08	4.3252	1.16	.0209	1.2749	1.4397	3.00
14	1.326	1.5269	3.10	4.7334	1.25	.0243	1.3503	1.5686	3.02
15	1.389	1.6370	3.14	5.1402	1.34	.0279	1.4169	1.6867	3.05
16	1.457	1.7587	3.16	5.5575	1.42	.0313	1.4883	1.8151	3.06

Bazin's Series, No. 161.
Crest length, 6.543 feet.
Crest height, 1.64 feet.

Cross section.

1	0.298	0.1627	4.31	0.701	0.36	0.0020	0.3000	0.1643	4.27
2	.354	.2107	4.30	.906	.45	.0031	.3571	.2133	4.25
3	.413	.2654	4.26	1.131	.56	.0049	.4179	.2702	4.19
4	.472	.3243	4.23	1.371	.65	.0066	.4786	.3314	4.14
5	.529	.3847	4.22	1.625	.75	.0087	.5377	.3946	4.12
6	.581	.4429	4.25	1.883	.85	.0112	.5922	.4555	4.13
7	.639	.5108	4.24	2.167	.95	.0140	.6530	.5277	4.11
8	.693	.5770	4.26	2.458	1.05	.0171	.7101	.5983	4.11
9	.750	.6495	4.28	2.782	1.16	.0209	.7709	.6770	4.11
10	.804	.7209	4.31	3.107	1.27	.0251	.8291	.7548	4.12
11	.864	.8031	4.31	3.461	1.38	.0296	.8936	.8452	1.10
12	.919	.8810	4.32	3.806	1.49	.0345	.9535	.9303	4.09
13	.960	.9406	4.33	4.073	1.57	.0383	.9983	.9970	4.08
14	.992	.9880	4.30	4.248	1.61	.0403	1.0323	1.0484	4.05
15	1.019	1.0287	4.31	4.434	1.67	.0434	1.0624	1.0944	4.05
16	1.056	1.0851	4.28	4.665	1.72	.0460	1.1020	1.1569	4.03
17	1.083	1.1271	4.27	4.825	1.78	.0493	1.1323	1.2044	4.01
18	1.118	1.1821	4.24	5.003	1.81	.0509	1.1689	1.2640	3.96
19	1.157	1.2445	4.17	5.171	1.84	.0526	1.2096	1.3310	3.88
20	1.187	1.2932	4.16	5.380	1.90	.0561	1.2431	1.3858	3.88
21	1.225	1.3558	4.12	5.378	1.95	.0591	1.2841	1.4550	3.83
22	1.263	1.4194	4.09	5.808	2.00	.0622	1.3252	1.5252	3.81
23	1.289	1.4635	4.11	6.001	2.05	.0653	1.3543	1.5756	3.81
24	1.326	1.5269	4.08	6.242	2.10	.0686	1.3946	1.6476	3.79
--	1.359	1.5843	4.08	6.446	2.15	.0719	1.4309	1.7118	3.76

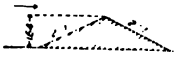
Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 163.
Crest length, 6.535 feet.
Crest height, 1.64 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	r	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.184	0.0790	3.81	0.301	0.17	0.0004	0.1844	0.0790	3.81
2	.244	.1206	3.83	.468	.25	.0009	.2449	.1213	3.82
3	.303	.1668	3.84	.641	.33	.0017	.3047	.1684	3.81
4	.366	.2215	3.83	.850	.42	.0027	.3687	.2241	3.79
5	.423	.2751	3.83	1.053	.51	.0040	.4270	.2791	3.77
6	.486	.3388	3.82	1.295	.61	.0058	.4915	.3441	3.76
7	.536	.3924	3.86	1.513	.69	.0074	.5431	.4001	3.78
8	.593	.4567	3.94	1.799	.81	.0102	.6032	.4683	3.84
9	.653	.5277	3.91	2.063	.90	.0126	.6656	.5435	3.80
10	.702	.5882	4.04	2.376	1.01	.0159	.7179	.6084	3.90
11	.769	.6744	3.98	2.683	1.11	.0189	.7878	.6995	3.84
12	.827	.7521	4.02	3.023	1.22	.0231	.8501	.7837	3.86
13	.882	.8268	4.02	3.329	1.32	.0271	.9091	.8667	3.84
14	.949	.9245	4.04	3.735	1.41	.0322	.9812	.9717	3.84
15	.998	.9970	4.06	4.048	1.53	.0361	1.0344	1.0514	3.85
16	1.056	1.0851	4.06	4.425	1.64	.0418	1.0978	1.1505	3.85
17	1.114	1.1758	4.05	4.779	1.74	.0471	1.1611	1.2510	3.82
18	1.171	1.2672	4.07	5.169	1.84	.0526	1.2236	1.3541	3.82
19	1.231	1.3658	4.07	5.576	1.94	.0585	1.2895	1.4635	3.81
20	1.285	1.4567	4.12	6.014	2.06	.0660	1.3510	1.5703	3.83
21	1.339	1.5495	4.17	6.464	2.17	.0732	1.4122	1.6779	3.85

Bazin's Series, No. 164.
Crest length, 6.534 feet.
Crest height, 1.64 feet.



Cross section.

1	0.244	0.1206	3.86	0.467	0.25	0.0009	0.2449	0.1213	3.85
2	.305	.1685	3.91	.659	.34	.0018	.3068	.1701	3.88
3	.367	.2224	3.87	.859	.43	.0030	.3700	.2251	3.82
4	.425	.2771	3.90	1.080	.52	.0042	.4292	.2810	3.84
5	.482	.3346	3.87	1.296	.61	.0058	.4878	.3409	3.80
6	.540	.3968	3.87	1.536	.70	.0076	.5476	.4057	3.79
7	.592	.4555	3.94	1.797	.81	.0102	.6022	.4671	3.85
8	.651	.5252	3.94	2.069	.90	.0126	.6636	.5410	3.82
9	.702	.5882	3.97	2.334	.99	.0152	.7172	.6071	3.84
10	.766	.6705	4.00	2.684	1.11	.0188	.7848	.6955	3.86
11	.817	.7385	4.03	2.978	1.21	.0228	.8398	.7699	3.87
12	.877	.8213	4.05	3.325	1.32	.0271	.9041	.8595	3.87
13	.939	.9100	4.07	3.704	1.41	.0322	.9722	.9583	3.86
14	.993	.9895	4.10	4.055	1.54	.0399	1.0299	1.0453	3.88
15	1.052	1.0790	4.09	4.417	1.64	.0418	1.0938	1.1412	3.86
16	1.115	1.1774	4.12	4.862	1.76	.0482	1.1632	1.2543	3.88
17	1.162	1.2526	4.13	5.163	1.84	.0526	1.2146	1.3392	3.86
18	1.219	1.3459	4.15	5.602	1.96	.0597	1.2787	1.4465	3.87
19	1.277	1.4431	4.18	6.019	2.06	.0660	1.3430	1.5564	3.87
20	1.330	1.5338	4.19	6.411	2.16	.0725	1.4025	1.6680	3.86

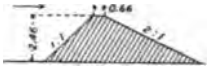
Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 165.
Crest length, 6.544 feet.
Crest height, 1.64 feet.

Cross section.

Period.	Observed head, experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.337	0.1957	3.56	0.698	0.35	0.0019	0.3389	0.1974	3.54
2	.401	.2540	3.56	.904	.44	.0030	.4040	.2568	3.52
3	.464	.3161	3.56	1.125	.54	.0045	.4685	.3202	3.51
4	.528	.3836	3.55	1.363	.63	.0062	.5342	.3902	3.49
5	.593	.4567	3.54	1.618	.73	.0083	.6013	.4660	3.47
6	.656	.5313	3.54	1.880	.82	.0105	.6665	.5435	3.46
7	.720	.6109	3.54	2.162	.92	.0132	.7332	.6276	3.44
8	.783	.6929	3.55	2.461	1.02	.0162	.7992	.7142	3.45
9	.843	.7740	3.58	2.771	1.11	.0192	.8622	.8003	3.46
10	.904	.8595	3.61	3.103	1.22	.0231	.9271	.8926	3.47
11	.969	.9538	3.63	3.462	1.33	.0275	.9965	.9940	3.48
12	1.029	1.0438	3.63	3.789	1.42	.0313	1.0603	1.0913	3.47
13	1.090	1.1380	3.64	4.150	1.52	.0359	1.1259	1.1948	3.47
14	1.158	1.2381	3.65	4.526	1.62	.0408	1.1938	1.3046	3.47
15	1.217	1.3426	3.66	4.904	1.71	.0455	1.2625	1.4178	3.46
16	1.279	1.4465	3.68	5.336	1.83	.0521	1.3311	1.5355	3.48
17	1.341	1.5529	3.68	5.704	1.92	.0573	1.3983	1.6530	3.45
18	1.401	1.6583	3.69	6.125	2.02	.0634	1.4644	1.7714	3.46
19	1.448	1.7424	3.73	6.490	2.10	.0686	1.5166	1.8680	3.47

Bazin's Series, No. 176.
Crest length, 6.519 feet.
Crest height, 2.46 feet.



Cross section.

1	0.237	0.1154	2.76	0.317	0.12	0.0002	0.2372	0.1154	2.75
2	.296	.1611	2.74	.441	.16	.0004	.2964	.1611	2.74
3	.365	.2206	2.92	.645	.23	.0008	.3658	.2214	2.91
4	.439	.2909	2.95	.858	.30	.0014	.4404	.2919	2.94
5	.494	.3472	3.04	1.055	.36	.0020	.4960	.3494	3.02
6	.565	.4247	3.10	1.318	.43	.0030	.5680	.4281	3.08
7	.618	.4858	3.19	1.550	.50	.0039	.6219	.4905	3.16
8	.682	.5632	3.22	1.813	.58	.0052	.6872	.5695	3.18
9	.738	.6276	3.29	2.066	.65	.0066	.7396	.6366	3.24
10	.797	.7115	3.35	2.385	.73	.0083	.8073	.7250	3.29
11	.861	.7989	3.41	2.724	.82	.0106	.8715	.8129	3.35
12	.910	.8681	3.45	2.995	.89	.0123	.9223	.8853	3.38
13	.974	.9613	3.51	3.373	.98	.0149	.9889	.9835	3.43
14	1.027	1.0408	3.53	3.671	1.05	.0171	1.0441	1.0667	3.44
15	1.088	1.1349	3.57	4.034	1.14	.0202	1.1082	1.1663	3.46
16	1.139	1.2156	3.62	4.416	1.23	.0235	1.1625	1.2526	3.52
17	1.196	1.3079	3.65	4.782	1.30	.0263	1.223	1.3508	3.54
18	1.248	1.3942	3.68	5.115	1.38	.0296	1.2776	1.4448	3.54
19	1.303	1.4874	3.73	5.558	1.47	.0336	1.3366	1.5460	3.60
20	1.355	1.5773	3.75	5.925	1.55	.0374	1.3924	1.6423	3.61
[illegible]	1.400	1.6921	3.80	6.422	1.66	.0428	1.4628	1.7695	3.63

Bazin's experiments on weirs of irregular section—Continued.

Bazin's Series, No. 178.
Crest length, 6.518 feet.
Crest height, 2.46 feet.

Cross section.

Period.	Observed head experimental weir D, in feet.	$D^{\frac{3}{2}}$	C_1	Q, flow per foot, experimental weir, in cubic feet per second.	v	$\frac{v^2}{2g}$	H	$H^{\frac{3}{2}}$	C
1	2	3	4	5	6	7	8	9	10
1	0.222	0.1046	2.83	0.297	0.11	0.0002	0.2222	0.1046	2.84
2	.299	.1635	2.95	.482	.17	.0004	.2994	.1635	2.95
3	.367	.2224	2.96	.658	.23	.0008	.3678	.2233	2.95
4	.431	.2830	3.08	.872	.30	.0014	.4324	.2840	3.07
5	.491	.3441	3.13	1.077	.37	.0021	.4931	.3462	3.11
6	.556	.4146	3.19	1.323	.47	.0034	.5594	.4180	3.16
7	.614	.4811	3.24	1.558	.51	.0040	.6180	.4858	3.21
8	.669	.5472	3.28	1.794	.57	.0051	.6741	.5533	3.24
9	.732	.6263	3.33	2.085	.65	.0066	.7386	.6353	3.28
10	.789	.7009	3.36	2.355	.73	.0083	.7973	.7115	3.31
11	.847	.7796	3.43	2.675	.81	.0102	.8572	.7934	3.37
12	.906	.8624	3.46	2.983	.89	.0123	.9183	.8795	3.39
13	.966	.9494	3.51	3.331	.97	.0146	.9806	.9716	3.43
14	1.028	1.0423	3.53	3.671	1.05	.0171	1.0451	1.0683	3.44
15	1.083	1.1271	3.58	4.045	1.14	.0202	1.1032	1.1584	3.49
16	1.142	1.2204	3.60	4.392	1.22	.0231	1.1651	1.2575	3.49
17	1.195	1.3063	3.64	4.755	1.30	.0263	1.2213	1.3492	3.52
18	1.259	1.4127	3.66	5.170	1.39	.0300	1.2890	1.4635	3.53
19	1.314	1.5063	3.69	5.572	1.48	.0341	1.3481	1.5651	3.56
20	1.366	1.5965	3.72	5.952	1.55	.0374	1.4034	1.6618	3.58
21	1.424	1.6992	3.75	6.375	1.65	.0423	1.4663	1.7750	3.59

CORNELL UNIVERSITY HYDRAULIC LABORATORY.[a]

This laboratory, erected in 1898, includes a reservoir formed by a masonry dam on Fall Creek, at Ithaca, N. Y. An experimental channel is supplied with water from the pond and has, as its general dimensions, length, 400 feet; breadth, 16 feet; depth, 10 feet; bottom grade, 1:500. Fall Creek drains an area of 117 square miles, and affords a minimum water supply estimated at 12 second-feet. The hydraulic laboratory is located at Triphammer Falls, where a descent of 189 feet occurs. The weirs used in the experiments here described were erected in the concrete-lined experimental channel. The water supply was regulated by wooden head-gates, operated by lever, rack, and pinion, the outflow from the canal passing over the declivity below.

[a] In reducing the experiments at Cornell hydraulic laboratory the value of g for Ithaca, latitude 42° 27′, altitude 500 feet, has been taken as 32.16, making $\sqrt{2g}=8.02$, $\frac{1}{\sqrt{2g}}=0.015547$, $\frac{2}{3}\sqrt{2g}=5.35$.

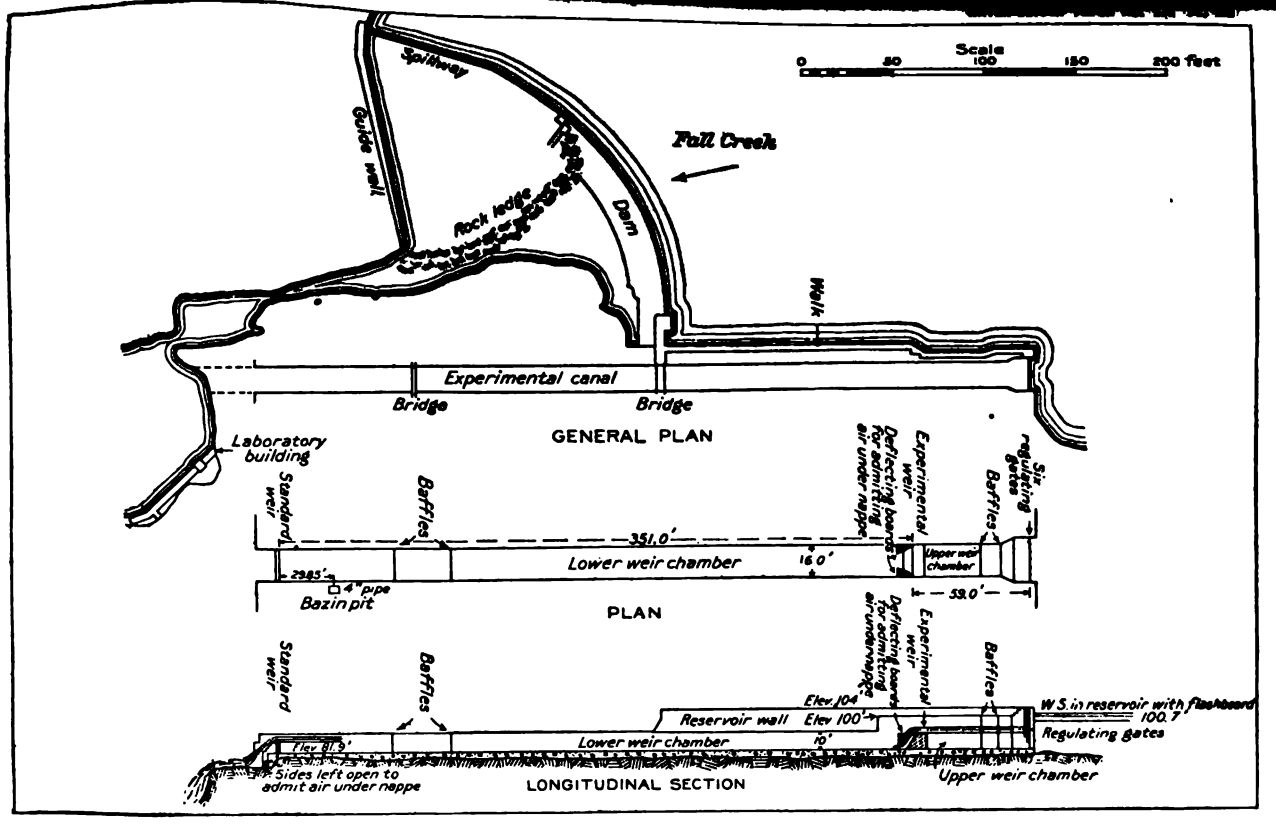
EXPERIMENTS OF UNITED STATES BOARD OF ENGINEERS ON DEEP WATERWAYS.

These experiments were performed at Cornell University hydraulic laboratory in May and June, 1899, for the United States Board of Engineers on Deep Waterways, under the immediate direction of George W. Rafter, engineer for water supply, in conjunction with Prof. Gardner S. Williams. The results of the original computations were published in Trans. Am. Soc. C. E., vol. 44, together with an extended discussion. In the experiments a closely regulated volume of water was passed over a standard thin-edged weir which was placed near the upper end of the experimental canal and had a height of 13.13 feet and a crest length of 16 feet, end contractions suppressed. The nappe was aerated, but was not allowed to expand on downstream side. The water flowed down the experimental canal past a series of screens and baffles and over the experimental weir placed at the lower end of the channel.

The experimental weirs were about 4.5 feet high and 6.56 feet crest length. A leading channel of planed boards, 6.56 feet wide and 48 feet in length, extended upstream from the experimental weir, having at its upper end flaring sides extending 8.3 feet upstream and meeting the sides of the main channel.

The head on both weirs was read by means of open manometers connected to galvanized-iron piezometer pipes, placed horizontally across the bottom of the narrow leading channel, 37 feet upstream from the weir. At the standard weir two piezometers were used, one termed the middle piezometer, placed across the leading channel, 6 inches above the bottom and 10 feet upstream from the standard weir. A second or upstream piezometer was placed 25 feet upstream from the standard weir. Readings of both piezometers were taken. It was decided, however, to use the middle piezometer as the basis of calculation of discharge over the standard weir. Near the close of the experiments it was found that this did not give results agreeing with those which would have been obtained from a piezometer placed flush with the bottom of the channel, as is shown to be necessary from the experiments of H. F. Mills[a] and others. A correction curve was accordingly deduced from comparative experiments between the middle piezometer and the flush piezometer, and the readings of the middle piezometer thus corrected were applied in the Bazin formula to calculate the discharge over the standard weir for heads not exceeding the limit of Bazin's experiments. For depths on the standard weir greater than 2 feet the discharge was computed by using coefficients deduced for higher heads on a shorter experimental weir, on the basis of the Francis formula. Owing to the uncertainty as to the piezometers and

[a] *Mills*, H. F., Experiments upon piezometers used in hydraulic investigations, Boston, 1878.



HYDRAULIC LABORATORY AT CORNELL UNIVERSITY, ITHACA, N. Y.

CORNELL HYDRAULIC LABORATORY, ARRANGED FOR WEIR EXPERIMENTS.

CORNELL HYDRAULIC LABORATORY, ARRANGED FOR WEIR EXPERIMENTS.

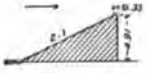
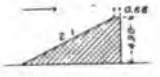
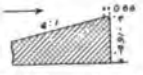
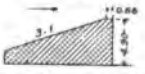
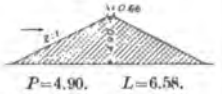
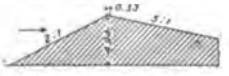
other conditions, the original results of the experiments were credited with a possible error of 5 or 6 per cent.

In connection with the experiments on models of the Croton dam, a very thorough comparison of the so-called upstream piezometer with other methods of obtaining the head on a standard weir was made by Professor Williams. It was found that the upstream piezometer gave the actual head on the standard weir correctly. These results were communicated to the writer, and a recomputation of the Deep Waterways experiments has been made, using readings of the upstream piezometer to calculate the standard weir discharge by Bazin's formula. This method of calculation eliminates the necessity for correcting the piezometer readings at the standard weir, as was necessary in the previous reductions. The discharge over the experimental weir has been calculated from readings of a piezometer placed 38 feet upstream from the weir and 8 inches above channel bottom, corrected to the basis of a flush piezometer.

The United States Deep Waterways experiments included, for each experimental model, a smaller number of heads or periods than either the Croton or United States Geological Survey experiments. They were also the first experiments of the kind conducted at the Cornell laboratory, and the experience gained has probably contributed to the securing of somewhat greater accuracy in the later experiments. It is believed, however, that, as recomputed, the United States Deep Waterways experiments do not differ much in accuracy from those made on models of the Croton dam, which are stated by John R. Freeman to be reliable within about 2 per cent. The coefficients obtained by recomputation, when compared with the original United States Deep Waterways coefficients, show few differences exceeding 2 per cent. The variations are plus and minus in about equal numbers, and it is believed that these experiments are entitled to greater weight than they have hitherto received.

In the accompanying tables a summary of the recomputation is given.

Recomputation of United States Deep Waterways Board experiments on flow of water model dams, Cornell University hydraulic laboratory, 1899.

Weir model.	Period.	Corrected depth D, experimental weir, centimeters.	D, in feet.	Q= flow per foot, in cubic feet per second.	V	$h=\frac{V^2}{2g}$	$H=D+h$	C_1	No. of values
1	2	3	4	5	6	7	8	9	
Series 1.  P=4.91. L=6.58.	1	.....	4.972	39.73	.....	.....	4.972	3.584	...
	2	.....	4.872	39.44	.....	.....	4.872	3.668	...
	3	.....	4.853	39.31	.....	.....	4.853	3.940	...
	4	.....	4.138	31.47	.....	.....	4.138	3.739	...
	5	.....	3.368	22.81	.....	.....	3.368	3.690	...
	6	.....	1.725	8.71	.....	.....	1.725	3.844	....
	7	.....	1.190	4.88	.....	.....	1.190	3.759	....
Series 2.  P=4.90. L=6.58.	1	.....	5.05	42.18	.....	.....	5.050	3.712	
	2	.....	4.15	31.17	.....	.....	4.150	3.758	
	3	.....	3.35	22.89	.....	.....	3.350	3.733	
	4	.....	2.55	15.03	.....	.....	2.550	3.691	
	5	.....	1.75	8.39	.....	.....	1.750	3.633	
	6	.....	.923	3.02	.....	.....	.923	3.406	
	7	.....	.34	.82	.....	.....	.340	4.120	
Series 3. P=4.91. L=6.58.	1	.....	.....	.....	.....	.....	5.23	3.393	
	2	.....	.....	.....	.....	.....	3.49	3.383	
	3	.....	.....	.....	.....	.....	1.75	3.382	
Series 4.  P=4.91. L=6.58.	1	.....	.....	.....	.....	.....	5.11	3.547	
	2	.....	.....	.....	.....	.....	4.28	3.373	
	3	.....	.....	.....	.....	.....	3.43	3.484	
	4	.....	.....	.....	.....	.....	2.57	3.485	
	5	.....	.....	.....	.....	.....	1.73	3.485	
	6	.....	.....	.....	.....	.....	.....	.....	....
Series 5.  P=4.90. L=6.58.	1	146.70	4.812	41.04	4.23	0.2782	5.0902	3.574	
	2	123.00	4.034	31.22	3.50	.1959	4.2299	3.593	
	3	98.80	3.242	21.49	2.65	.1092	3.3512	3.503	
	4	75.72	2.484	13.27	1.80	.0504	2.5344	3.289	
	5	50.65	1.662	8.21	1.24	.0239	1.6859	3.751	
Series 7. P=4.865. L=6.58.	1	142.75	4.682	41.40	4.30	.2875	4.9695	3.737	
	2	119.20	3.969	30.72	3.47	.1872	4.1562	3.626	
	3	96.72	3.173	21.64	2.67	.1108	3.2938	3.637	
	4	74.50	2.444	14.07	1.92	.0573	2.5013	3.557	
Series 8.[a]  P=4.90. L=6.58.	1	144.00	4.723	41.22	4.28	.2848	5.0078	3.678	
	2	120.50	3.953	30.50	3.45	.1850	4.1380	3.623	
	3	97.27	3.192	21.53	2.62	.1067	3.299	3.591	
	4	74.35	2.439	14.18	1.92	.0573	2.4963	3.595	
	5	49.77	1.633	7.63	1.17	.0213	1.6543	3.585	
Series 9.  P=4.94. L=6.58.	1	147.10	4.825	41.16	4.20	.2742	5.0992	3.575	
	2	123.00	4.034	30.47	3.38	.1776	4.2116	3.525	
	3	99.62	3.268	21.48	2.62	.1067	3.3927	3.437	
	4	76.22	2.500	14.24	1.92	.0573	2.5573	3.482	
	5	51.00	1.673	7.85	1.19	.0220	1.6950	3.557	

[redacted]*me as series 7,* but upstream face covered with ¼-inch mesh galvanized wire netting.

mputation of United States Deep Waterways Board experiments on flow of water over model dams, Cornell University hydraulic laboratory, 1899—Continued.

Weir model.	Period.	Corrected depth D, experimental weir, centimeters.	D, in feet.	Q = flow per foot, in cubic feet per second.	V	$h = \frac{V^2}{2g}$	$H = D + h$	C_1	Number of observations of head.
1	2	3	4	5	6	7	8	9	10
Series 10.	1	153.82	5.046	42.01	4.37	0.2969	5.3429	3.402	21
	2	132.94	4.361	31.27	3.50	.1904	4.5514	3.220	21
	3	110.98	3.641	22.33	2.72	.1150	3.7560	3.068	20
	4	87.99	2.887	14.77	1.99	.0616	2.9486	2.917	17
P=4.57. L=6.58.	5	61.70	2.024	8.12	1.24	.0239	2.0479	2.771	17
Series 11.	1	149.15	4.892	42.06	4.45	.3079	5.1999	3.547	.....
	2	127.70	4.189	31.66	3.60	.2015	4.3905	3.418	.....
	3	105.60	3.464	22.02	2.72	.1150	3.5790	3.252	.....
	4	82.52	2.707	14.34	1.97	.0603	2.7673	3.115	.....
P=4.57. L=6.58.	5	58.80	1.930	8.26	1.26	.0247	1.9547	3.022	.....
Series 12.	1	154.55	5.069	30.69	3.19	.1582	5.219	2.574	.....
	2	126.80	4.160	21.58	2.48	.0956	4.2556	2.458	.....
	3	96.75	3.174	14.12	1.82	.0515	3.2255	2.438	.....
P=4.56. L=6.58.	4	66.30	2.174	7.85	1.17	.0213	2.1953	2.413	.....
Series 13.	1	144.70	4.747	30.69	3.28	.1673	4.9143	2.817	.....
	2	116.60	3.825	21.75	2.60	.1051	3.9301	2.790	.....
	3	88.52	2.904	14.07	1.90	.0561	2.9601	2.763	.....
	4	60.02	1.969	7.85	1.19	.0220	1.9910	2.859	.....
P=4.56. L=6.58.	5	30.80	1.010	2.89	.51	.0040	1.0140	2.830	.....
Series 14.	1	157.05	5.151	41.16	4.23	.2782	5.4292	3.254	.....
	2	131.60	4.317	30.64	3.45	.1850	4.5020	3.208	.....
	3	105.40	3.458	21.68	2.72	.1150	3.5730	3.212	.....
	4	80.25	2.633	14.07	1.97	.0603	2.6933	3.183	.....
	5	54.25	1.780	7.78	1.21	.0239	1.8039	3.219	.....
=4.53. L=6.58.	6	28.05	.920	2.75	.51	.0040	.9240	3.096	.....
Series 15.	1	129.55	4.250	31.12	3.55	.1959	4.4459	3.329	.....
	2	105.01	3.444	21.87	2.72	.1150	3.5590	3.257	.....
	3	79.52	2.608	14.02	1.97	.0603	2.6683	3.217	.....
=4.53. L=6.58.	4	53.65	1.760	7.95	1.26	.0247	1.7847	3.333	.....
Series 16.	1	126.75	4.157	30.69	3.52	.1926	4.3496	3.383	.....
	2	102.55	3.364	21.87	2.75	.1176	3.4816	3.366	.....
	3	78.02	2.559	14.02	1.97	.0603	2.6193	3.307	.....
=4.57. L=6.58.	4	52.00	1.706	7.73	1.24	.0239	1.7299	3.397	.....
Series 17.	1	127.30	4.175	31.08	3.55	.1959	4.3709	3.401	.....
	2	103.32	3.389	21.87	2.75	.1176	3.5066	3.331	.....
	3	78.39	2.571	14.34	2.02	.0634	2.6344	3.354	.....
=4.57. L=6.58.	4	51.57	1.691	7.73	1.24	.0239	1.7149	3.442	.....
	5	32.40	1.063	3.82	.68	.0072	1.0702	3.450	.....
Series 18.	1	38.523	1.264	5.47	.92	.0132	1.2772	3.790	.....
	2	149.362	4.899	40.19	4.23	.2782	5.1772	3.412	.....
	3	125.693	4.123	30.25	3.45	.1850	4.3080	3.383	.....
	4	100.766	3.305	21.38	2.70	.1133	3.4183	3.383	.....
=4.65 L=6.58.	5	75.427	2.474	13.85	1.94	.0585	2.5825	3.437	.....

Recomputation of United States Deep Waterways Board experiments on flow of water model dams, Cornell University hydraulic laboratory, 1899—Continued.

Weir model.	Period.	Corrected depth D, experimental weir, centimeters.	D, in feet.	Q= flow per foot, in cubic feet per second.	V	$h=\frac{V^2}{2g}$	$H=D+h$	C_1	N b ol vs h
1	2	3	4	5	6	7	8	9	
Series 19. P=5.28. L=6.58.	1	27.04	0.8869	2.75	0.44	0.0030	0.8899	3.276	...
	2	51.36	1.685	7.46	1.07	.0178	1.7028	3.357	...
	3	142.128	4.662	40.04	4.20	.2742	4.9362	3.651	...
	4	119.442	3.918	29.62	3.23	.1622	4.0802	3.594	...
	5	97.858	3.210	20.78	2.45	.0933	3.3033	3.461	...
	6	77.246	2.534	14.17	1.82	.0515	2.5855	3.401	...
	7	53.42	1.752	7.68	1.09	.0185	1.7705	3.260	...

Column 5 shows the discharge over the experimental weir per f of crest, deduced from the readings of the upstream piezometer at standard weir, by Bazin's formula, and corrected for slight leaka

Column 3 shows the head on the experimental weir, in centimet taken by a piezometer 38 feet upstream and 8 inches above chan bottom, corrected to reduce it to the equivalent reading of the fl piezometer.

Column 4 shows the equivalent head in feet.

Column 6 shows the absolute velocity of approach.

Column 7 shows the velocity head.

Column 8 shows the head corrected for velocity of approach; correction being made by the simple addition of the velocity hea the measured head, which is assumed to be a sufficiently precise eq alent to the Francis correction formula for this purpose.

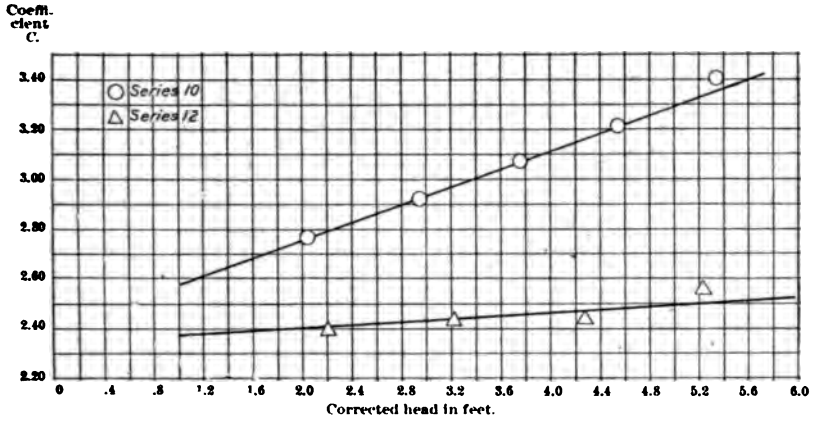
Column 9 gives the coefficient C_1, deduced from the foregoing.

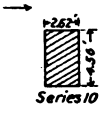
The resulting coefficient diagrams are shown on Pls. XV to XV inclusive.

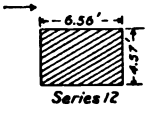
EXPERIMENTS AT CORNELL UNIVERSITY HYDRAULIC LABORATORY MODELS OF OLD CROTON DAM.[a]

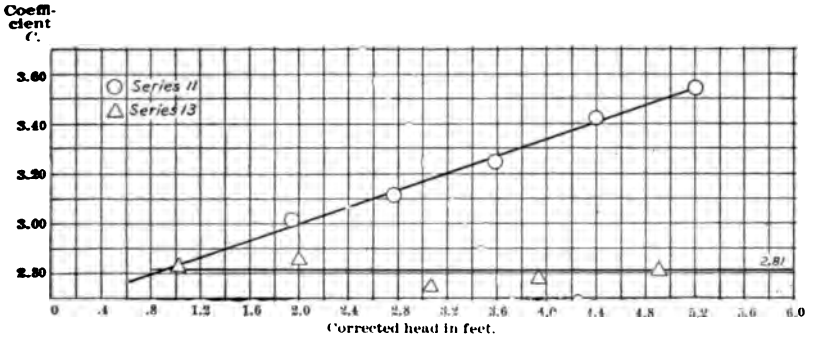
These experiments were made in November and December, 1 by Prof. Gardner S. Williams, under the direction of John R. F man. The standard weir used was located near the head of the exp mental canal, water being admitted and regulated by head-gates in usual manner. The standard weir was 11.25 feet high and 16 long on the crest. The experimental weir was placed 232.5 feet ther downstream, and also occupied the full width of the experime canal. The models of the Croton dam were constructed of frai timber and were 6 to 9 feet high.

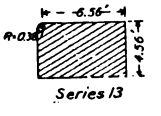
a Report on New York's water supply, Freeman, 1900, pp. 139–141.



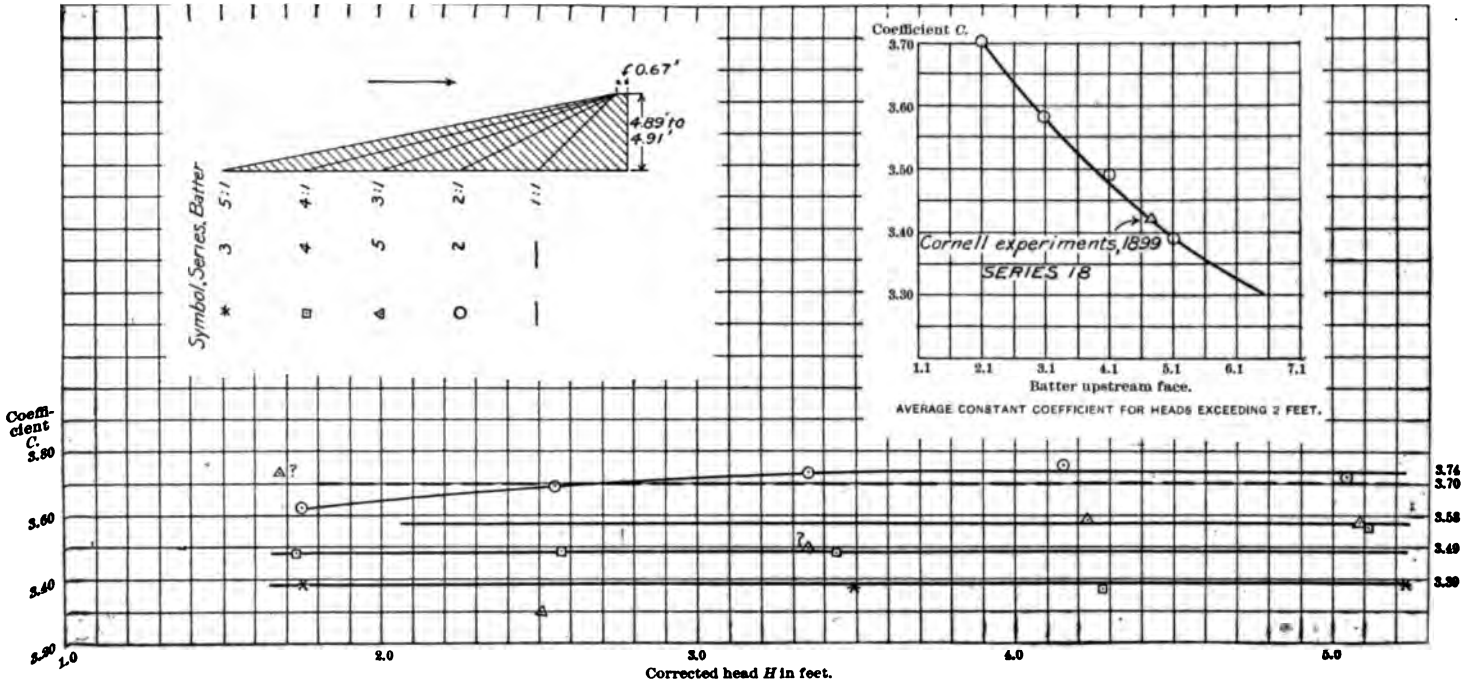




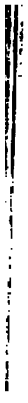


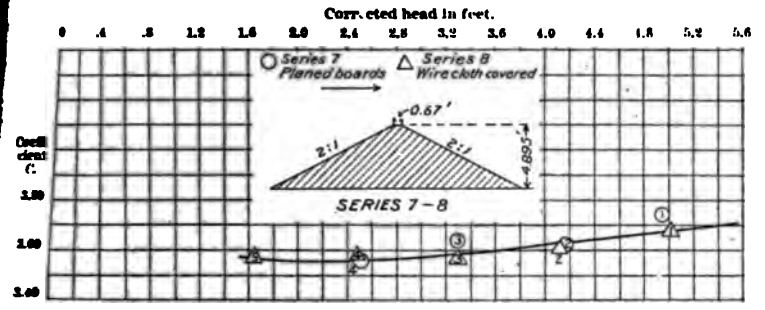


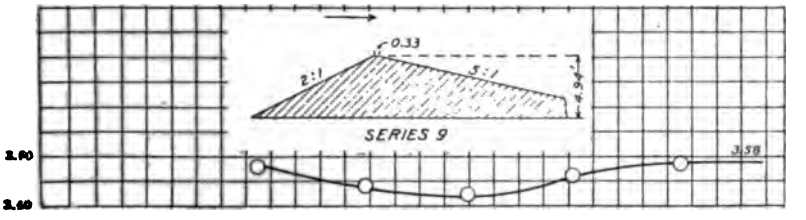
EXPERIMENTS OF UNITED STATES DEEP WATERWAYS BOARD AT CORNELL UNIVERSITY, 1899.

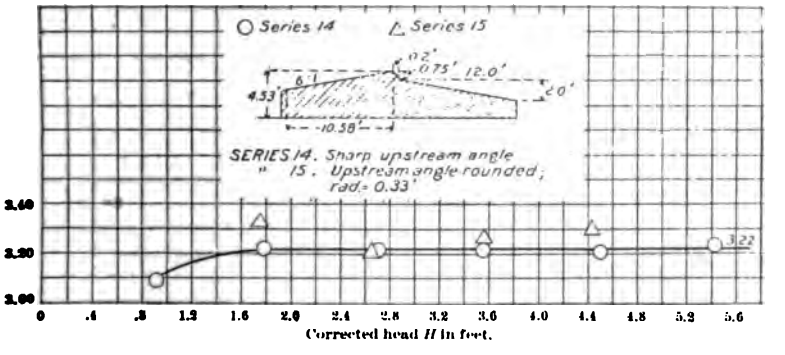


EXPERIMENTS OF UNITED STATES DEEP WATERWAYS BOARD AT CORNELL UNIVERSITY, 1899.

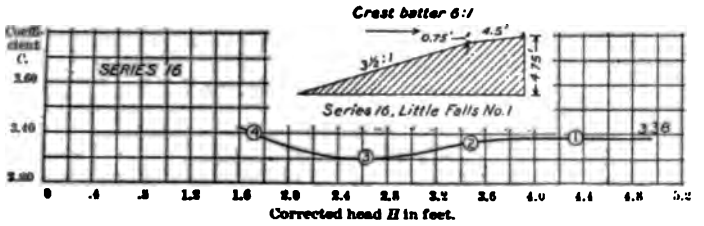


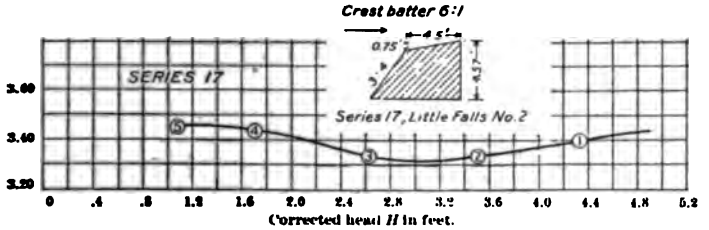


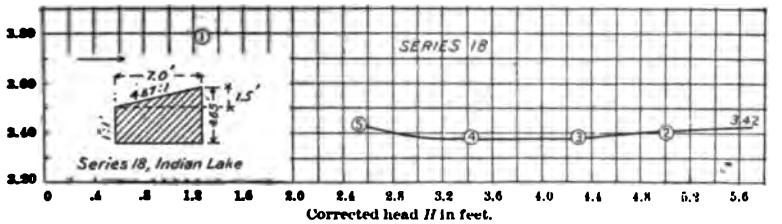


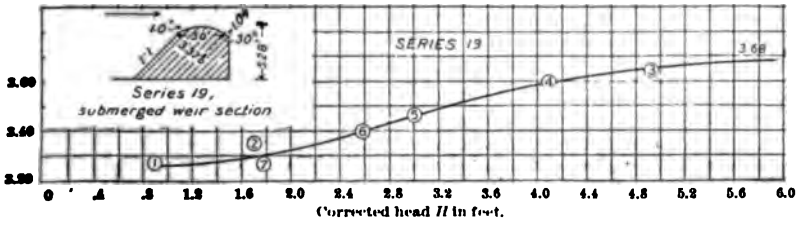


EXPERIMENTS OF UNITED STATES DEEP WATERWAYS BOARD AT CORNELL UNIVERSITY, 1899.

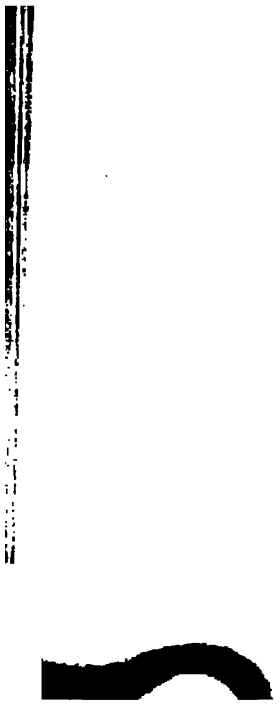








EXPERIMENTS OF UNITED STATES DEEP WATERWAYS BOARD AT CORNELL UNIVERSITY, 1899.



The head on the weirs was measured by means of open glass manometers connected to piezometer tubes in the channel above each weir. The piezometer tubes were made of 1-inch galvanized-iron pipe with small holes drilled along the sides, the ends being plugged. At the standard weir three piezometers were used, placed parallel to the current, at about mid-depth of the channel, one being near each side and one at mid-width of the channel, the mid-length of the pipes being 26.5 feet upstream from the standard weir. A hook gage in the same section was used to check the observed head.

Experiments on volume of flow over models of old Croton dam, Cornell University hydraulic laboratory, 1899.

1	Period No. 2	Observed depth on model dam, in feet. 3	Mean velocity of approach, in feet per second. 4	Correction for velocity of approach, in feet. 5	Corrected head on model dam, in feet. 6	Discharge over model dam per foot of length, in cubic feet per second. 7	C_1 8
Series 1—Model A.	1	2.7229	1.685	0.0439	2.7668	14.762	3.208
Round crest, old Croton dam, smooth pine, crest and slope 16 feet long. Nov. 28–29, 1899.	2	2.1857	1.283	.0259	2.2116	10.562	3.211
	3	1.4388	.749	.0087	1.4475	5.604	3.218
	4	.9830	.449	.0031	.9861	3.154	3.222
	5	.5907	.219	.0008	.5915	1.451	3.190
	6	.1230	.024	.0000	.1230	.147	3.408
Series 1a—Model A.	1	2.0897	.978	.0149	2.1046	9.578	3.137
Round crest, old Croton dam, unplaned plank, crest 16 feet long, smooth slope. Nov. 6, 1899.	2	1.8293	.810	.0102	1.8395	7.883	3.160
	3	1.5878	.661	.0068	1.5946	6.284	3.121
	4	1.2562	.467	.0034	1.2596	4.287	3.032
	5	.9929	.338	.0018	.9947	3.006	3.030
	6	.6301	.175	.0004	.6305	1.494	2.988
	7	.1871	.111	.0002	.1873	.991	2.913
Series 2—Model A.	1	2.9227	1.839	.0526	2.9753	16.475	3.240
Round crest, old Croton dam, 16-foot smooth crest, rough slope formed of cleats and stone to simulate concrete and riprap. Dec. 4, 1899.	2	2.8591	1.794	.0500	2.9091	15.969	3.218
	3	2.4948	1.516	.0357	2.5305	12.933	3.213
	4	2.1420	1.248	.0211	2.1661	10.211	3.203
	5	1.6238	.880	.0120	1.6358	6.710	3.222
	6	1.2597	.623	.0060	1.2657	4.548	3.194
	7	1.1119	.515	.0046	1.1165	3.913	3.188
	8	.7196	.288	.0013	.7209	1.945	3.178
	9	.1873	.166	.0004	.1877	1.087	3.192
Series 3—Model A.	1	2.0030	1.124	.0197	2.0187	9.037	3.148
Round crest, old Croton dam, 16-foot crest, covered with wire cloth of No. 18 wire, ½-inch mesh,[a] rough slope, as in series 2. Nov. 28, 1899.	2	1.4091	.712	.0078	1.4129	5.308	3.161
	3	.8675	.366	.0021	.8656	2.527	3.138
	4	.4288	.133	.0003	.4251	.861	3.099
	5	.1184	.020	.0000	.1144	.124	3.205

[a] In experiments [illegible] wire cloth over crest, 0.004 foot is deducted from observed depth to compensate for thickness of wire.

Experiments on volume of flow over models of old Croton dam, Cornell University hy lic laboratory, 1899—Continued.

1	Period No.	Observed depth on model dam, in feet.	Mean velocity of approach, in feet per second.	Correction for velocity of approach, in feet.	Corrected head on model dam, in feet.	Discharge over model dam per foot of length, in cubic feet per second.
	2	3	4	5	6	7
Series 1—Model B.	1	1.8635	0.973	0.0147	1.8782	9.506
	2	.9246	.370	.0021	.9267	3.272
Angular crest, old Croton dam, 16-foot crest, all unplaned plank. Nov. 15, 1899.	3	.6419	.219	.0008	.6427	1.870
	4	.3481	.090	.0001	.3482	.741
	5	.1787	.034	.0000	.1787	.272
Series 2—Model B.	1	2.4126	1.298	.0262	2.4388	13.478
	2	1.5251	.736	.0084	1.5335	6.945
Angular crest, old Croton dam, 16-foot unplaned plank, crest slope roughened with cleats and stone. Nov. 28, 1899.	3	.9611	.391	.0024	.9635	3.466
	4	.5157	.162	.0004	.5161	1.369
	5	.3051	.077	.0001	.3052	.631
	6	.0890	.012	.0000	.0890	.094
Series 2—Continued model B.	1	1.8930	.988	.0151	1.9081	9.683
	2	.9605	.391	.0024	.9629	3.465
Conditions as in preceding. Nov. 16, 1899.	3	.7028	.251	.0010	.7038	2.165
	4	.3941	.108	.0002	.3943	.900
	5	.1952	.039	.0000	.1952	.314
Series 3—Model B.	1	2.0053	1.047	.0170	[a]2.0183	10.385
	2	.9787	.389	.0024	.9771	3.463
Angular crest, old Croton dam, wire cloth on crest, rough slope. Nov. 16, 1899.	3	.7391	.259	.0011	.7362	2.241
	4	.1785	.032	.0000	.1745	.260
Series 1—Model C.	1	1.9941	1.097	.0187	2.0128	9.904
	2	1.1817	.512	.0040	1.1857	4.211
	3	.8832	.328	.0017	.8849	2.594
Round crest, old Croton dam, 12-inch timber on crest, 16 feet long, rough slope. Dec. 1, 1899.	4	.6873	.222	.0008	.6881	1.722
	5	.4986	.141	.0003	.4989	1.065
	6	.2992	.071	.0001	.2993	.522
	7	.1177	.019	.0000	.1177	.139
	8	.0846	.009	.0000	.0846	.067
Series 1—Continued model C.	1	2.7146	1.632	.0414	2.7560	15.917
	2	2.4519	1.436	.0320	2.4839	13.629
Conditions as in preceding. Dec. 4, 1899.	3	1.5566	.774	.0093	1.5659	6.660
	4	1.1046	.016	.0000	.1046	.112
	5	.1070	.0165	.0000	.1070	.118
Series 1—Model D.	1	1.2390	.495	.0038	1.2428	5.026
Angular crest, old Croton dam, 12-inch timber, on 16-foot crest, rough slope. Nov. 16, 1899.	2	.7885	.249	.0010	.7895	2.415
	3	.4448	.113	.0002	.4450	1.054

[a] In experiments with wire cloth over crest, 0.004 foot is deducted from observed depth to pensate for thickness of wire.

ts on volume of flow over models of old Croton dam, Cornell University hydraulic laboratory, 1899—Continued.

1	Period No. 2	Observed depth on model dam, in feet. 3	Mean velocity of approach, in feet per second. 4	Correction for velocity of approach, in feet. 5	Corrected head on model dam, in feet. 6	Discharge over model dam per foot of length, in cubic feet per second. 7	C_1 8
	1	2.3051	1.154	0.0207	2.3258	11.778	3.321
	2	1.8125	.845	.0111	1.8236	8.214	3.336
Series 1—Model E.	3	1.2278	.507	.0040	1.2318	4.632	3.388
ular crest, old Croton dam, with-	4	.8598	.313	.0015	.8613	2.744	3.433
er, but with obstructed channel,	5	.5745	.179	.0005	.5750	1.516	3.477
rp contraction. Nov. 18, 1899.	6	.3245	.078	.0001	.3246	.641	3.466
	7	.1120	.017	.0000	.1120	.133	3.548
	8	.1102	.017	.0000	.1102	.140	3.827
	1	1.4569	.636	.0063	1.4632	5.957	3.366
	2	.9168	.338	.0018	.9186	2.982	3.387
ieries 1—Model E, repeated.	3	.6866	.237	.0009	.6875	2.037	3.573
i as in preceding. Nov. 25, 1899.	4	.4820	.148	.0003	.4823	1.240	3.702
	5	.2811	.071	.0001	.2812	.579	3.883
	6	.1416	.028	.0000	.1416	.226	4.203
	1	2.2927	1.139	.0202	2.3129	[a]11.613	3.302
	2	2.2914	1.138	.0202	2.3116	[b]11.606	3.302
Series 2—Model E.	3	1.1395	.473	.0034	1.1429	4.278	3.501
rest, old Croton dam, 16 feet long	4	1.1403	.453	.0031	1.1434	[a]4.097	3.351
timber, and with slope instead of	5	1.1006	.448	.0031	1.1037	[b]4.034	3.479
ge to upstream end of obstruction.	6	1.1099	.457	.0032	1.1131	4.119	3.507
1899.	7	.4763	.141	.0003	.4766	1.180	3.586
	8	.0233	.031	.0000	.0233	.025	7.029

[a] Trap open. [b] Trap closed.

ıe experimental weir two similar piezometers, each about one f the width of the channel from the side, were used. Owing long back slope of some of the model dams, the head was ed 69.75 feet upstream from the crest of the experimental Readings of all the piezometers were taken at half-minute ls, two and sometimes three observers working at each weir. ean of ten to twenty observations was used to determine the or each period in the experiment. Freeman states that he rs the results of these experiments for heads up to 2.5 feet, ng all sources of errors, as certainly correct within 2 per nd probably much closer. In reducing the experiments, the ı the experimental weir is corrected by a method comparable ıat of Francis. Freeman does not give the resulting coefficients weir formula, but presents the results in the form of diagrams g the discharge per foot of crest for the various models. In ompanying tables the computations have been carried out to

show the coefficients, some errors in the original data having be omitted.

Column 3 shows the observed head on the experimental dam, in fe

Column 7 shows the computed discharge over the experimental da per foot of crest. This was determined by calculating the discha over the standard weir by means of both the Francis and Bazin fo mulas, the mean of the two having been used. The result correcte for slight leakage, divided by 16 (the length in feet of the experi mental weir model), appears in column 7.

Columns 4 and 5 show the velocity of approach and the correspond ing velocity head at the experimental weir. The velocity of approac correction was made by adding directly the velocity head as given t the observed depth on the model dam, this being considered a suffi ciently close approximation to the Francis method of correction.

Columns 1 to 7 are taken from the original computations. Th coefficient C_1 has been computed from the data in columns 6 and 7 by the formula

$$C_1 = \frac{Q}{H^{\frac{3}{2}}}.$$

Pls. XIX to XXII show the resulting coefficients applicable in th formula here adopted,

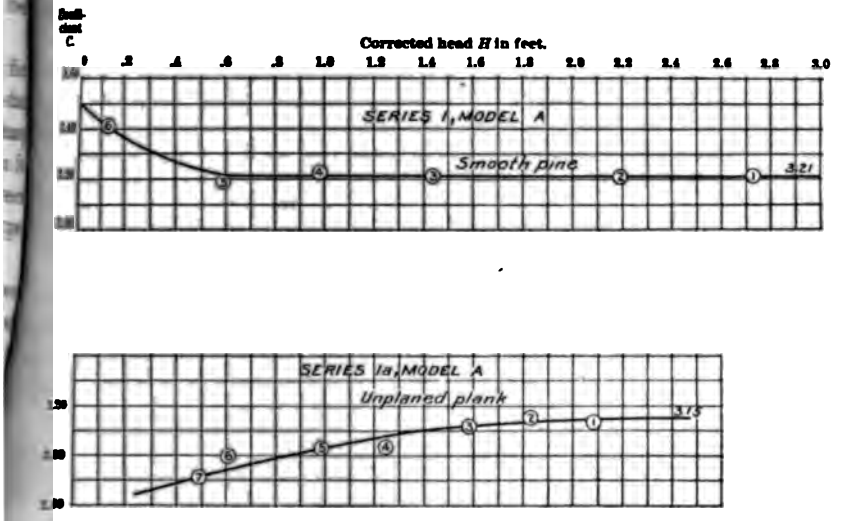
$$Q = C_1 L H^{\frac{3}{2}},$$

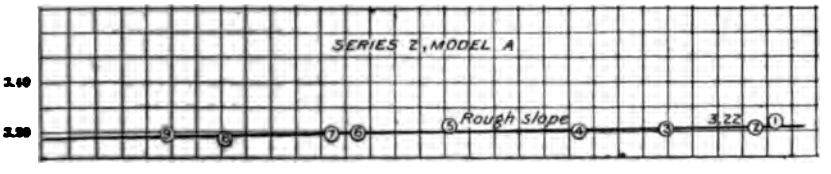
correction for velocity of approach being made by the Francis correc tion formula or an equivalent method.

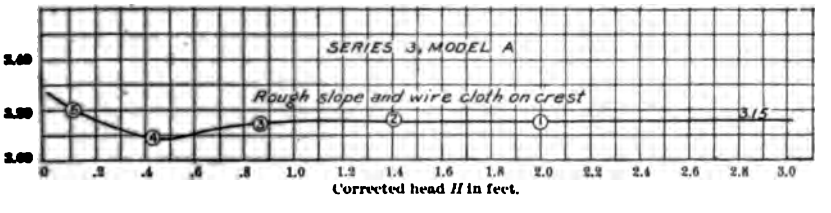
These experiments were performed for the specific purpose o determining the discharge over the old Croton dam. They includ two main groups: (1) Experiments on round-crested portion of th dam; (2) experiments on the angular-crested portion of the dam Each group includes series of experiments on: (*a*) Model of smooth planed pine; (*b*) model of unplaned plank; (*c*) model with cleats an fragments of stone on the upstream slope to simulate the natural bac filling; (*d*) model with rough slope and with ¼-inch-mesh wire cloth o crest to simulate cut stone; (*e*) model surmounted by 12-inch-squar timber on crest. Experiments were added with a construction t simulate a natural rock ledge lying upstream from the angular portio of the dam.

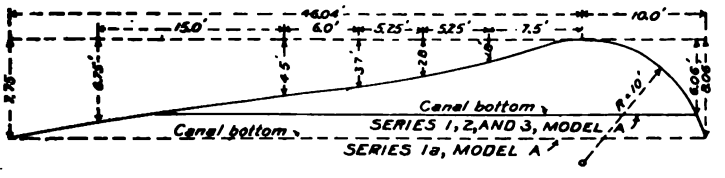
The experiments were abbreviated owing to lateness of season an trouble from air in the gage pipes.

The value of the results is limited by the narrow range of hea covered. The models were of unusual forms, and show some peculia differences when an attempt is made to compare the results with tho of other weirs of similar slopes. The data are of value as showing th various degrees of roughness on the discharge.

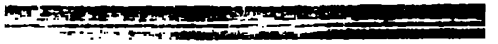

Coefficient C
Corrected head H in feet.
0 .2 .4 .6 .8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4 2.6 2.8 3.0
SERIES 1, MODEL A
Smooth pine
3.21
SERIES 1a, MODEL A
Unplaned plank
3.13

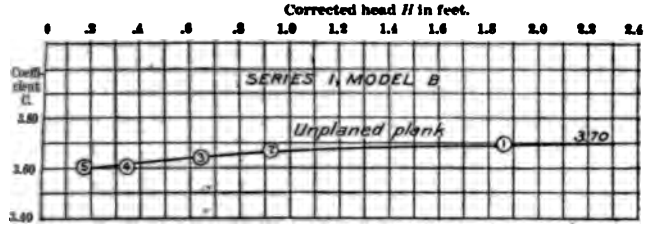


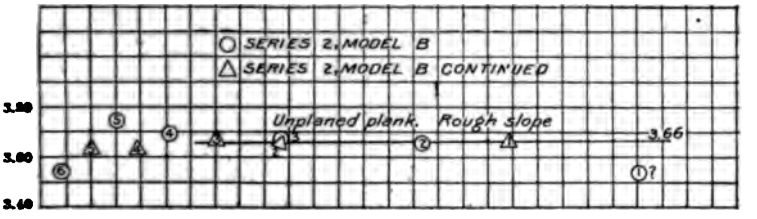


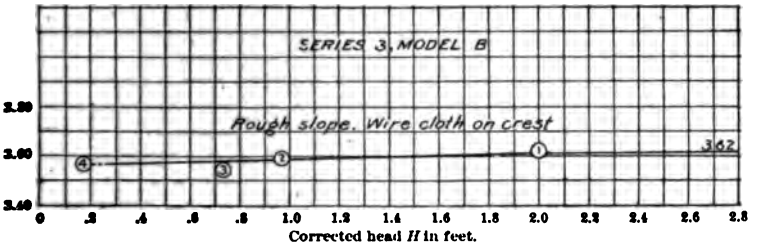


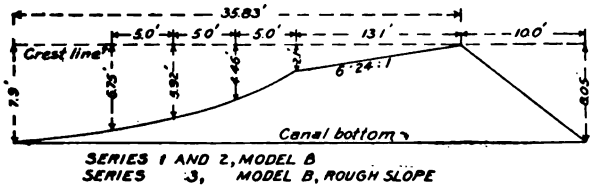
EXPERIMENTS ON ROUND-CRESTED MODELS OF OLD CROTON DAM.





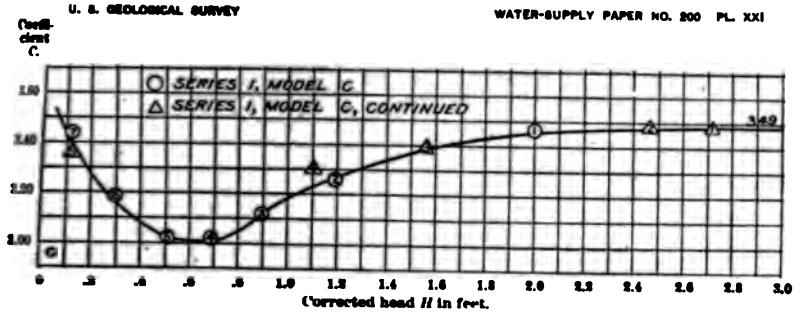


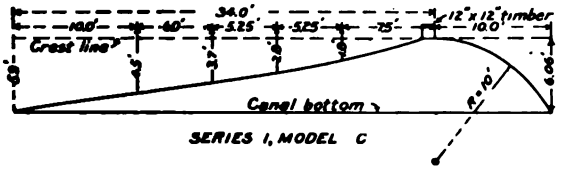




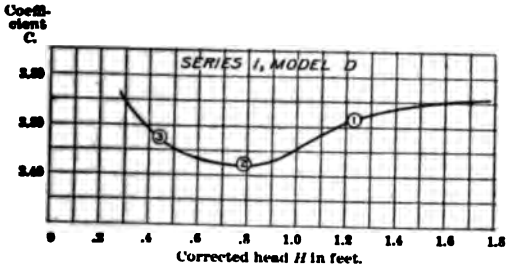
SERIES 1 AND 2, MODEL B
SERIES 3, MODEL B, ROUGH SLOPE

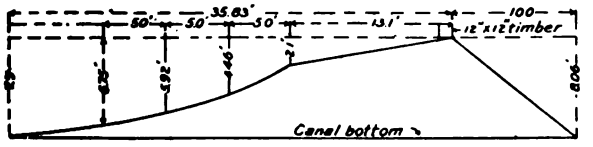
EXPERIMENTS ON ANGULAR-CRESTED MODELS OF OLD CROTON DAM.





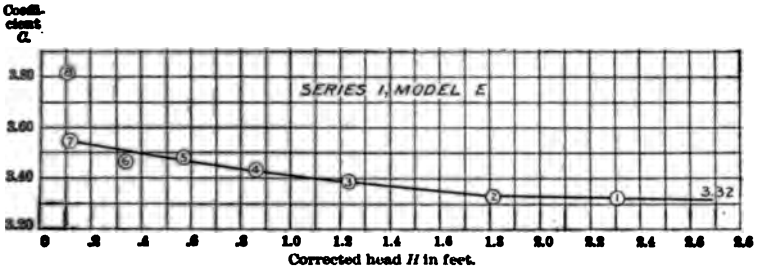
SERIES I, MODEL C

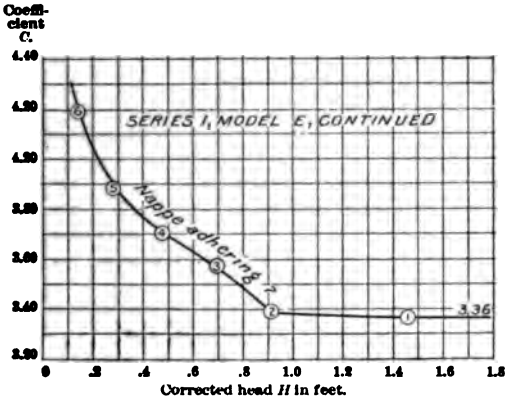


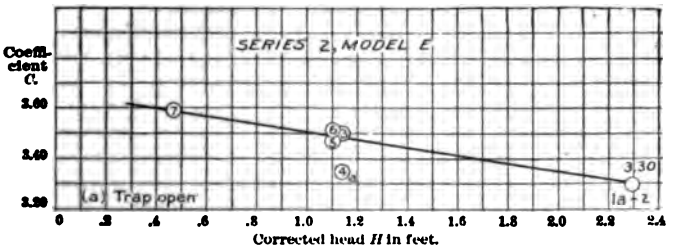


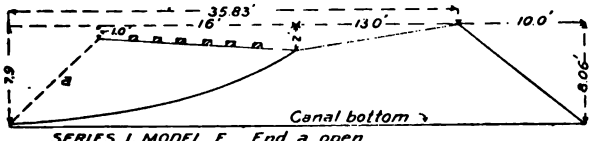
SERIES I, MODEL D

OLD CROTON DAM MODELS WITH CREST TIMBER.









SERIES 1, MODEL E. End a open
SERIES 2. MODEL E End a with sloping approach

ANGULAR CROTON DAM MODEL, WITH CONSTRUCTION TO SIMULATE ROCK LEDGE.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY AT CORNELL UNIVERSITY HYDRAULIC LABORATORY.

In April, 1903, the writer was instructed to plan and execute a series of experiments on models of dams similar to those in use at gaging stations of the Geological Survey in New York, Michigan, and elsewhere.

The experiments were performed at the hydraulic laboratory of Cornell University, mainly during the months of May and June, 1903, and were conducted, under the supervision of the writer, by Prof. Gardner S. Williams, director of the laboratory.

The various types of dams most commonly occurring were grouped as follows:

1. Weirs with broad horizontal or slightly inclined crests.
2. Weirs with vertical downstream faces and inclined upstream slopes.
3. Weirs having compound slopes, including those with inclined upstream faces and with either broad crests or with sloping aprons.
4. Completely or partially curved weir sections, including those of ogee profile.

It was found impossible to include in the experiments all the forms of section desired, and it was accordingly determined to limit the experiments to the thorough study of two classes—weirs with broad crests and weirs with ogee sections—and to extend, if possible, the measurements to include dams with vertical downstream faces and sloping upstream approaches. The order of operation used in previous experiments was transposed, the experimental models being built on a bulkhead forming the standard weir hitherto used and located near the head of the experimental canal.

The quantity of water passing over the experimental weir was measured on a standard weir below, 6.65 feet high and having a crest length of 15.93 feet. The head on the standard weir was measured in a Bazin pit, 3 by 4 feet in section, reaching to the depth of the bottom of the canal, and communicating therewith through a pipe 4 inches in diameter and about 3.5 feet long, opening at the bottom of the channel of approach, 29.88 feet upstream from the weir. The head on the standard weir was observed in the gage pit by means of a hook gage reading to millimeters and estimated to about one-fifth millimeter. The conditions at the standard weir were thus closely comparable to those obtained in Bazin's experiments, and his formula for this height and length of weir was applied to determine the discharge. Observations to determine the leakage between the experimental and standard weirs were made, and corrections were applied for whatever leakage was indicated, the amount being usually less than 0.01 cubic foot per second per foot of crest. The discharge over the standard weir was com-

puted in cubic meters per second and has been reduced to cubic feet per second, the discharge table being as follows:

Discharge over standard weir at different heads.

Head, in meters.	Q in cubic meters, per second.	Head, in meters.	Q in cubic meters, per second.
0.05	0.111863	0.60	4.21730
.10	.296230	.70	5.34459
.15	.53207	.80	6.57096
.20	.81166	.90	7.89078
.25	1.12871	1.00	9.30650
.30	1.48032	1.10	10.81066
.40	2.27850	1.20	12.40420
.50	3.19350		

The discharge curve for the standard weir has also been carefully checked by comparing the depth flowing over with that on a similar weir, using the formula and method of determining the head adopted by Fteley and Stearns; it has also been checked by float and current-meter measurements, and for lower heads by means of volumetric measurement of the discharge in the gaging channel, so that it is believed that the discharge in these experiments is known within 1 or 2 per cent of error as a maximum.

The work of calibrating the standard weir had been accomplished by Professor Williams and his assistants before the experiments of the United States Geological Survey were taken up, so that somewhat more certainty attaches to the results of these later experiments than to earlier experiments made before the standard-weir discharge had been thoroughly checked.

It was the wish of the Geological Survey that the conditions at the experimental weirs should conform to those actually existing at dams which are utilized as weirs, in connection with the stream-gaging operations. In such cases it is often impracticable to utilize gage pits of the form adopted by Bazin or to use piezometer or hook gages. The usual method is to read the depth directly on a graduated vertical scale or measure the distance to water surface from a suitable bench mark. The method adopted in the weir experiments consisted of reading directly the distance to water surface from bench marks located above the central line of the channel. The readings were taken by means of a needle-pointed plumb bob attached to a steel tape forming a point gage, readings being taken to thousandths of a foot.

Two gages were used, one located 10.3 feet upstream from the crest and another 16.059 feet upstream. In series XXXV and *following*, for the higher heads, the readings of the upstream tape were used. For heads where no general difference was apparent the mean of the readings of the two tapes was taken. In general, th

irface curve did not perceptibly affect the reading of the gage nearest ie weir for depths below 3 feet. The readings of the tapes were hecked from time to time by observations with hook gages, thus prac-ically eliminating the effect of temperature on the tapes. Observa-ions of the head were usually taken at intervals of thirty seconds. Great care was used to maintain a uniform regimen of flow during each experimental period, and the variations of head were very slight. The character of the observations is illustrated by the following data taken from the experiments:

Readings of tapes to determine head at experimental weir.

Series XL. Period 10. Date 6,22,03.				Series XLI. Period 5. Date 6,23,03.			
Time.			Readings.	Time.			Readings.
h.	*m.*	*s.*		*h.*	*m.*	*s.*	
12	37	40	42.681	1	34	30	43.633
			.681				.632
			.680				.633
			.681				.630
12	39	00	.682				.630
12	52	30	42.680				.633
			.681				.635
			.680				.635
			.679				.634
12	54	30	.680				.633
Mean			42.6805				.630
							.635
Series XLIII. Period 3. Date 6,26.03.							.630
							.635
							.635
Time.			Readings.				.633
							.630
h.	*m.*	*s.*					.630
12	36	20	2.305				.630
			.302				.630
			.302				.630
			.302				.634
			.301				.630
			.302				.628
			.301				.630
			.300				.632
12	42	10	.300				.628
Mean			2.3015	1	51	20	.631
				Mean			43.6317

For the lower heads the discharge over the experimental weir was volumetrically determined by measuring the rise of water in the canal, as follows:

List of experimental periods for which the discharge was volumetrically determined.

Series.	Periods.	Series.	Periods.	Series.	Periods.
30	1, 13, 14, 16	39	1	44	1, 2, 3
31	10, 11	40	1, 2	45	1, 2, 3
34	1, 9, 10	41	13, 14	46	1, 2, 3
37	5 [a]	43	1, 2, 3	47	1, 2, 3
38	5, 6	43 [a]	1, 2, 3, 4		

United States Geological Survey experiments at Cornell University hydraulic laboratory on model of Plattsburg dam.

[Series No. XXX. Height of weir=P, 11.25 feet; length of weir crest=L, 15.969 feet; width of channel=b, 15.970 feet; height of upstream crest corner, 10.50 feet; crest width, 3 feet.]

No.	Measured head on experimental weir, in feet.				A= area of section per foot of crest.	v= mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		Q=discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.
	Number of observations.	Maximum.	Minimum.	Mean $=D$.			$H^{\frac{3}{2}}$	H		
1	2	3	4	5	6	7	8	9	10	11
1	92	0.0993	0.0818	0.096	11.347	0.007	0.030	0.096	0.084	2.835
2	31	.7993	.7863	2.790	14.041	1.155	4.710	2.810	16.218	3.443
3	19	3.1993	3.1473	3.187	14.438	1.396	5.766	3.216	20.152	3.495
4	26	2.3993	2.3473	2.384	13.635	.926	3.710	2.396	12.631	3.405
5	29	1.7973	1.7853	1.793	13.043	.636	2.412	1.799	8.282	3.433
6	27	1.1803	1.1723	1.174	12.425	.354	1.274	1.176	4.399	3.454
7	18	1.0133	1.0073	1.010	12.260	.280	1.016	1.011	3.435	3.381
8	16	.8043	.8003	.802	12.053	.200	.719	.803	2.409	3.348
9	34	.6143	.6113	.613	11.864	.136	.481	.614	1.608	3.345
10	24	.5083	.5073	.508	11.758	.102	.362	.508	1.195	3.302
11	15	.4283	.4263	.427	11.678	.079	.280	.428	.921	3.296
12	20	.2943	.2903	.291	11.542	.046	.157	.291	.526	3.344
13	32	.2933	.2903	.292	11.543	.044	.158	.292	.506	3.209
14	21	.1783	.1763	.178	11.427	.021	.075	.178	.240	3.202
15	24	.1793	.1733	.179	11.429	.020	.076	.179	.226	2.976
16	40	.0893	.0893	.089	11.340	.007	.027	.089	.076	2.841
17	26	1.5373	1.5303	1.532	12.783	.517	1.901	1.535	6.607	3.471
18	25	2.1033	2.0843	2.094	13.345	.793	3.061	2.104	10.576	3.466

United States Geological Survey experiments at Cornell University hydraulic laboratory on model of Plattsburg dam—Continued.

[Series No. XXXI. Height of weir = P, 11.25 feet; length of weir crest = L, 7.938 feet; width of channel = b, 15.970 feet; height of upstream crest corner, 10.50 feet; width of crest, 3 feet.]

No.	Measured head on experimental weir, in feet.				A = area of section per foot of crest.	v = mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		Q = discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.	L = effective length of crest weir.
	Number of observations.	Maximum.	Minimum.	Mean = D.			$H^{\frac{3}{2}}$	H			
1	2	3	4	5	6	7	8	9	10	11	12
1	25	5.1003	4.9273	5.0014	259.535	1.201	11.257	5.023	41.925	3.724	7.436
2	15	4.2873	4.1693	4.2214	247.078	.945	8.714	4.235	31.086	3.567	7.514
3	44	3.6893	3.5253	3.6191	507.460	.356	6.890	3.621	23.868	3.464	7.580
4	21	2.8213	2.8003	2.8185	224.674	.551	4.743	2.823	16.170	3.409	7.656
5	39	2.2713	2.2623	2.2696	215.780	.412	3.425	2.273	11.545	3.377	7.711
6	40	1.3903	1.3813	1.3861	201.998	.206	1.633	1.387	5.338	3.269	7.799
7	26	.9673	.9653	.9663	195.094	.125	.950	.966	3.120	3.284	7.841
8	25	1.8793	1.8723	1.8749	209.605	.326	2.570	1.876	8.814	3.429	7.750
9	30	.6093	.6083	.6087	189.383	.065	.475	.609	1.562	3.288	7.877
10	18	.6073	.6063	.6068	189.345	.060	.472	.606	1.456	3.083	7.877
11	40	.3023	.2993	.3017	184.471	.020	.165	.301	.469	2.838	7.908
12	19	.3003	.2993	.3017	184.481	.021	.166	.302	.490	2.956	7.908

[Series No. XXXII. Height of weir = P, 11.25 feet; length of weir crest = L, 7.979 feet; width of channel = b, 15.970 feet; height of upstream crest corner, 9.75 feet; width of crest, 3 feet.]

1	10	2.1193	2.0943	2.1173	213.476	0.004	3.081	2.117	11.029	3.580	7.767
2	23	4.0343	3.9863	4.0053	243.627	.928	8.055	4.018	29.846	3.706	7.577
3	26	2.6693	2.6333	2.6469	221.934	.535	4.317	2.651	15.398	3.567	7.714
4	34	.9953	.9923	.9942	195.540	.135	.992	.994	3.342	3.370	7.890
5	32	5.5543	5.2963	5.4712	267.038	1.404	12.855	5.487	50.440	3.924	7.480
6	27	4.7343	4.6443	4.6947	254.637	1.141	10.235	4.714	38.704	3.782	7.508
7	27	4.0173	3.9683	4.0007	240.808	.925	8.040	4.013	29.395	3.656	7.578
8	28	3.3053	3.2673	3.2890	232.188	.701	5.984	3.296	21.278	3.556	7.649
9	31	2.5663	2.5193	2.5596	220.539	.506	4.104	2.564	14.460	3.524	7.723
10	28	1.9913	1.9693	1.9801	211.285	.357	2.790	1.982	9.686	3.471	7.781
11	53	1.4113	1.4023	1.4015	202.044	.221	1.661	1.402	5.704	3.434	7.839

United States Geological Survey experiments at Cornell University hydraulic laboratory on model of Plattsburg dam—Continued.

[Series No. XXXIII. Height of weir=P, 11.25 feet; length of weir crest=L, 15.969 feet; width o channel=b, 15.970 feet; height of upstream crest corner, 9.79 feet; width of crest, 3 feet.]

No.	Measured head on experimental weir, in feet.				A = area of section per foot of crest.	v = mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		Q=discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.
	Number of observations.	Maximum.	Minimum.	Mean $=D$.			$H^{\frac{3}{2}}$	H		
1	2	3	4	5	6	7	8	9	10	11
1	15	0.7563	0.7493	0.752	12.003	0.183	0.653	0.753	2.197	3.363
2	43	.9973	.9873	.992	12.243	.281	.990	.993	3.439	3.473
3	29	1.3963	1.3903	1.394	12.644	.468	1.651	1.397	5.913	3.580
4	33	1.7893	1.7803	1.784	13.034	.671	2.396	1.790	8.747	3.651
5	23	2.3733	2.3363	2.352	13.603	.990	3.641	2.367	13.464	3.698
6	24	2.6683	2.6503	2.660	13.910	1.170	4.387	2.680	16.272	3.709
7	52	.5593	.5493	.553	11.803	1.183	.432	.572	1.397	3.232
8	42	.6603	.6493	.653	11.904	.152	.528	.654	1.808	3.422
9	12	.6804	.6783	.679	11.930	.156	.560	.680	1.866	3.330

[Series No. XXXIV. Height of weir=P, 11.25 feet; length of weir crest=L, 15.969 feet; width c channel=b, 15.970 feet; height of upstream crest corner, 8.37 feet; width of crest, 3 feet.]

1	16	0.6453	0.6383	0.641	11.891	0.137	0.513	0.641	1.632	3.182
2	16	.6423	.6383	.640	11.891	.141	.513	.640	1.680	3.276
3	21	2.0253	2.0043	2.015	13.266	.816	2.882	2.025	10.826	3.756
4	19	1.6303	1.6203	1.628	12.878	.592	2.086	1.633	7.627	3.656
5	19	1.2333	1.2293	1.232	12.483	.391	1.371	1.235	4.877	3.555
6	14	.9523	.9483	.950	12.201	.261	.927	.951	3.185	3.434
7	20	.4013	.3983	.400	11.650	.070	.253	.400	.815	3.225
8	10	.6243	.6243	.624	11.875	.136	.493	.625	1.613	3.269
9	32	.2243	.2203	.222	11.473	.029	.105	.222	.328	3.133
10	39	.1103	.1093	.110	11.360	.009	.036	.110	.100	2.777
11	14	5.0963	5.0793	3.089	14.340	1.509	5.515	3.122	21.636	3.923
12	25	2.7763	2.7263	2.749	14.000	1.258	4.615	2.772	17.612	3.816
13	31	2.4383	2.3963	2.421	13.672	1.061	3.805	2.437	14.374	3.778
14	25	2.8013	2.7963	.800	12.050	.194	.716	.800	2.341	3.271

United States Geological Survey experiments at Cornell University hydraulic laboratory on model of Chambly dam.

[Series No. XXXV. Height of weir=P, 11.25 feet; length of weir crest=L, 15.969 feet; width of channel=b, 15.970 feet; height of upstream crest corner, 10.25 feet; width of crest 4.5 feet.]

No.	Measured head on experimental weir, in feet.				A = area of section per foot of crest.	V = mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		Q = discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.
	Number of observations.	Maximum.	Minimum.	Mean = D.			$H^{\frac{3}{2}}$	H		
1	2	3	4	5	6	7	8	9	10	11
1	64	2.5508	2.5463	0.549	11.799	0.110	0.407	0.549	1.297	3.189
2	55	1.0103	1.0063	1.008	12.259	.272	1.014	1.009	3.331	3.285
3	40	1.5643	1.5523	1.559	12.810	.511	1.954	1.563	6.548	3.352
4	40	2.0273	2.0133	2.021	13.272	.744	2.890	2.029	9.874	3.416
5	38	1.7513	1.7303	1.739	12.990	.602	2.304	1.744	7.816	3.392
6	45	1.2673	1.2583	1.262	12.513	.379	1.422	1.265	4.747	3.337
7	41	.7593	.7543	.757	12.008	.176	.660	.758	2.114	3.205
8	43	.4453	.4373	.441	11.692	.079	.293	.441	.919	3.132
9	20	.3043	.3003	.302	11.553	.045	.166	.302	.525	3.159
11	18	3.7303	3.7063	3.755	15.006	1.740	7.403	3.798	26.114	3.528
12	17	3.2193	3.1813	3.195	14.446	1.406	5.789	3.224	20.319	3.510
13	17	3.0023	2.9873	2.987	14.238	1.283	5.224	3.011	18.267	3.496
14	18	2.6743	2.6643	2.642	13.892	1.077	4.334	2.658	14.963	3.452
15	23	2.3583	2.3283	2.317	13.568	.901	3.555	2.330	12.221	3.438
16	22	1.4923	1.4873	1.463	12.713	.478	1.775	1.466	6.072	3.420
17	37	.2103	.2003	.184	11.435	.023	.079	.184	.258	3.260
18	25	.3913	.3903	.391	11.642	.065	.215	.391	.758	3.096
19	17	.3313	.3313	.331	11.582	.053	.191	.331	.609	3.194
20	24	.2523	.2523	.253	11.504	.035	.127	.253	.404	3.258
21	21	.2203	.2193	.221	11.472	.028	.104	.221	.325	3.120
22	24	.1843	.1833	.183	11.434	.021	.078	.185	.238	3.039
23	19	.1323	.1313	.132	11.383	.012	.048	.132	.136	2.826
24	20	.0823	.0823	.083	11.334	.007	.021	.083	.079	3.321

Series No. XXXVI. Height of weir = P, 11.25 feet; length of weir crest = L, 15.969 feet; width of channel = b, 15.970 feet; height of upstream crest corner, 10.50 feet; width of crest, 4.5 feet, with 4 inches radius quarter round.]

1	18	2.7653	2.6913	2.741	13.991	1.185	4.594	2.764	16.586	3.610
2	18	2.3513	2.2913	2.316	13.567	.936	3.558	2.330	12.698	3.569
3	30	2.9373	2.8923	1.915	13.166	.702	2.666	1.923	9.243	3.467
4	23	1.5173	1.4993	1.507	12.758	.501	1.857	1.511	6.390	3.441
5	21	1.1143	1.1013	1.111	12.361	.320	1.173	1.112	3.950	3.367
6	19	.7553	.7493	.753	12.004	.177	.654	.753	2.123	3.248
7	22	.4943	.4903	.492	11.743	.095	.345	.492	1.113	3.221

United States Geological Survey experiments at Cornell hydraulic laboratory on model Dolgeville dam with injured apron.

[Series No. XXXVII. Height of weir=P, 11.25 feet; length of weir crest=L, 15.969 feet; width channel=b, 15.970 feet; height of upstream crest corner, 10.25 feet; width of crest, 6 feet.]

No.	Measured head on experimental weir, in feet.				A= area of section per foot of crest.	v= mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		Q=discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.
	Number of observations.	Maximum.	Minimum.	Mean=D.			$H^{\frac{3}{2}}$	H		
1	2	3	4	5	6	7	8	9	10	11
1	30	0.9203	0.9113	0.916	12.166	0.251	0.878	0.917	3.049	3.474
2	35	3.5613	3.4233	3.565	14.816	1.535	6.828	3.599	22.744	3.331
3	28	2.9123	2.8573	2.927	14.178	1.170	5.060	2.947	16.593	3.279
4	52	2.3293	2.2903	2.324	13.574	.906	3.570	2.336	12.297	3.444
5	59	1.6413	1.6213	1.635	12.885	.585	2.100	1.640	7.544	3.593
5a	41	1.3973	1.3923	.415	11.666	.069	.267	.415	.810	3.029

United States Geological Survey experiments at Cornell hydraulic laboratory on model Dolgeville dam.

[Series No. XXXVIII. Height of weir=P, 11.25 feet; length of weir crest=L, 15.969 feet; width channel=b, 15.970 feet; height of upstream crest corner, 10.25 feet; width of crest, 6 feet.]

No.	Measured head on experimental weir, in feet.				A= area of section per foot of crest.	v= mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		Q=discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.
	Number of observations.	Maximum.	Minimum.	Mean=D.			$H^{\frac{3}{2}}$	H		
1	2	3	4	5	6	7	8	9	10	11
1	32	0.3973	0.3913	0.395	11.646	0.068	0.249	0.396	0.790	3.176
2	36	1.6843	1.6713	1.689	12.940	.605	2.206	1.695	7.826	3.548
3	25	1.1143	1.1093	1.112	12.362	.333	1.175	1.114	4.113	3.501
4	32	.7513	.7473	.749	12.000	.185	.649	.750	2.223	3.426
5	34	.5093	.5083	.504	11.754	.101	.358	.504	1.186	3.310
6	24	.2173	.2113	.209	11.460	.026	.096	.209	.294	3.081
7	27	3.4726	3.4586	3.470	14.721	1.466	6.551	3.501	21.583	3.295
8	34	3.1176	3.0806	3.100	14.351	1.271	5.521	3.124	18.238	3.303
9	29	2.6176	2.5926	2.605	13.856	1.019	4.243	2.621	14.124	3.329
10	30	2.2096	2.1806	2.198	13.449	.846	3.283	2.209	11.381	3.467
11	28	1.9306	1.8156	1.920	13.171	.726	2.677	1.928	9.558	3.570
12	28	1.5286	1.5106	1.517	12.768	.514	1.872	1.519	6.557	3.503

[Series No. XXXIX. Height of weir=P, 11.25 feet; length of weir crest=L, 15.969 feet; width channel=b, 15.700 feet; height of upstream crest corner, 10.25 feet; width of crest, 6 feet.]

1	26	0.6883	0.6793	0.683	11.934	0.170	0.565	0.684	2.027	3.586
2				.683	11.934	.167	.565	.684	1.995	3.530
3	22	.4183	.4153	.418	11.668	.081	.270	.418	.944	3.497
4	33	3.9806	3.9206	3.943	15.194	1.721	7.956	3.985	26.150	3.287
5	24	3.1506	3.1366	3.145	14.396	1.280	5.642	3.169	18.431	3.266
6	23	2.5066	2.4806	2.488	13.739	.966	3.958	2.502	13.268	3.352
7	36	1.8986	1.8756	1.884	13.135	.699	2.601	1.891	9.186	3.532
8	32	1.2716	1.2626	1.268	12.518	.401	1.432	1.270	5.025	3.509
9	39	.8286	.8206	.826	12.077	.218	.752	.827	2.639	3.494
	32	.5626	.5606	.561	11.811	.125	.420	.561	1.481	3.598

United States Geological Survey experiments at Cornell hydraulic laboratory on model of flat-top weirs with vertical faces.

Series No. XL. Height of weir = P, 11.25 feet; length of weir crest = L, 15.969 feet; width of channel = b, 15.970 feet; width of broad crest, 0.479 foot; nappe aerated.]

No.	Measured head on experimental weir, in feet.				A = area of section per foot of crest.	v = mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		Q = discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.
	Number of observations.	Maximum.	Minimum.	Mean = D.			$H^{\frac{3}{2}}$	H		
1	2	3	4	5	6	7	8	9	10	11
1	19	0.6343	0.6293	0.631	11.882	0.133	0.502	0.632	1.580	3.148
2	17	.2643	.2593	.260	11.511	.030	.133	.260	.343	2.584
3	18	.2613	.2513	.264	11.515	.033	.136	.261	.380	2.791
4	30	.1216	.1206	.124	11.375	.011	.044	.124	.129	2.943
5	33	1.9916	1.9816	1.989	13.238	.710	2.821	1.996	9.401	3.332
6	36	1.6256	1.6106	1.618	12.868	.530	2.065	1.622	6.819	3.301
7	26	1.2556	1.2496	1.256	12.507	.377	1.412	1.259	4.713	3.338
8	21	.9756	.9706	.977	12.228	.262	.967	.978	3.209	3.318
9	21	.8213	.8163	.820	12.070	.204	.743	.820	2.469	3.325
10	10	.6513	.6493	.650	11.900	.139	.521	.650	1.651	3.154
11	10	.4503	.4483	.449	11.700	.074	.301	.449	.867	2.881

ies No. XLI. Height of weir = P, 11.25 feet; length of weir crest = L, 15.969 feet; width of channel = b, 15.970 feet; width of broad crest, 1.646 feet; nappe partly aerated.]

1	25	3.8606	3.8256	3.842	15.092	1.692	7.651	3.883	25.531	3.337
2	25	3.1706	3.1666	3.177	14.428	1.317	5.730	3.202	18.995	3.315
3	26	2.6906	2.6656	2.674	13.925	1.050	4.413	2.690	14.624	3.314
4	31	2.0306	2.0116	2.022	13.272	.680	2.889	2.028	9.021	3.123
5	28	1.6043	1.5973	1.601	12.852	.462	2.032	1.604	5.936	2.922
6	27	1.2373	1.2293	1.233	12.481	.307	1.372	1.231	3.835	2.796
7	25	.9443	.9393	.942	12.192	.203	.915	.942	2.476	2.706
8	34	.6733	.6693	.671	11.922	.123	.575	.692	1.472	2.560
9	30	.4893	.4873	.488	11.739	.078	.341	.488	.910	2.669
10	18	.3303	.3293	.330	11.581	.045	.190	.330	.520	2.742
11	34	.2113	.2093	.210	11.461	.024	.096	.210	.272	2.827
12	.....	.....	.....	.122	11.373	.011	.043	.122	.130	3.047
13	22	.1253	.1213	.788	12.038	.153	.699	.788	1.810	2.631
14	20	.4206	.4136	.417	11.668	.064	.270	.417	.750	2.782
15	44	.4206	.4126	.417	11.668	.065	.270	.417	.759	2.815

. XLII. Height of weir = P, 11.25 feet; length of weir crest = L, 15.969 feet; width of channel = b, 15.970 feet; width of broad crest, 12.239 feet; nappe partly aerated.]

1	33	0.1706	0.1626	0.168	11.418	0.016	0.069	0.168	0.180	2.611
2	32	4.3706	4.3416	4.353	15.601	1.584	9.196	4.389	24.716	2.688
3	26	3.8316	3.8006	3.809	15.060	1.321	7.510	3.835	19.896	2.649
4	38	3.0446	3.0256	3.032	14.283	.971	5.317	3.046	13.876	2.610
5	32	3.7356	3.7186	1.728	12.979	.467	2.278	1.732	6.066	2.663
6	29	3.5856	3.5776	2.580	13.831	.787	4.166	2.589	10.882	2.612
7	38	3.3966	3.3806	3.387	14.638	1.130	6.285	3.406	16.535	2.631
8	27	2.2506	2.2406	2.243	13.194	.657	3.373	2.249	8.870	2.629
9	34	1.4706	1.4526	1.449	12.760	.369	1.718	1.451	4.682	2.701
10	22	1.0986	1.0906	1.096	12.347	.253	1.149	1.097	3.129	2.723
11	36	.6406	.6376	.639	11.890	.116	.511	.639	1.375	2.689
12	28	.6126	.6106	.611	11.862	.109	.478	.611	1.290	2.700

United States Geological Survey experiments at Cornell hydraulic laboratory on model flat-top weirs with vertical faces—Continued.

[Series No. XLIII. Height of weir = P, 11.25 feet; length of weir crest = L, 15.969 feet; width of chann b, 15.970 feet; width of broad crest, 16.302 feet; surface somewhat rough; nappe partly aerated.

No.	Measured head on experimental weir, in feet.				A = area of section per foot of crest.	v = mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		Q = discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.
	Number of observations.	Maximum.	Minimum.	Mean = D.			$H^{\frac{3}{2}}$	H		
1	2	3	4	5	6	7	8	9	10	11
1	12	0.8536	0.8506	0.851	12.102	0.168	0.786	0.852	2.027	2.579
2	12	.4496	.4426	.447	11.698	.069	.299	.447	.811	2.713
3	10	.3246	.3106	.312	11.563	.040	.174	.312	.468	2.684
4	26	.6936	.6856	.689	11.940	.129	.573	.690	1.544	2.696
5	33	4.4506	4.4176	4.432	15.683	1.595	9.449	4.469	25.011	2.647
6	27	3.6806	3.6306	3.661	14.912	1.251	7.076	3.686	18.657	2.637
7	34	2.9426	2.9306	2.935	14.186	.930	5.062	2.948	13.200	2.608
8	30	2.3626	2.3586	2.360	13.611	.706	3.644	2.368	9.607	2.637
9	23	1.8956	1.8866	1.890	13.141	.520	2.607	1.894	6.841	2.624
10	25	1.4826	1.4756	1.480	12.731	.374	1.804	1.482	4.767	2.531
11	26	1.2086	1.2026	1.206	12.457	.282	1.327	1.208	3.520	2.652

[Series No. XLIIIa. Height of weir = P, 11.25 feet; length of weir crest = L, 15.969 feet; width of ch nel = b, 15.970 feet; width of broad crest, 16.302 feet; smooth planed surface.]

1	19	0.3626	0.3596	0.361	11.612	0.050	0.217	0.361	0.576	2.653
2	20	.2496	.2426	.246	11.497	.026	.122	.246	.305	2.494
3	44	.1686	.1646	.167	11.418	.013	.068	.167	.153	2.240
4	16	.9906	.9846	.986	12.236	.214	.980	.986	2.618	2.673
5	28	.9856	.9776	.981	12.232	.210	.973	.982	2.568	2.638
6	23	.7886	.7826	.786	12.036	.153	.697	.786	1.847	2.651
7	31	.6226	.6206	.621	11.872	.110	.490	.622	1.309	2.670
8	21	.4976	.4946	.496	11.747	.080	.350	.496	.945	2.704
9	25	.3926	.3906	.392	11.643	.058	.246	.392	.670	2.728
10	31	.2806	.2786	.280	11.530	.036	.148	.280	.421	2.848
11	28	.1606	.1606	.161	11.411	.016	.064	.161	.184	2.851
12	24	.0776	.0756	.077	11.327	.006	.021	.077	.066	3.127

[Series No. XLIV. Height of weir = P, 11.25 feet; length of weir crest = L, 15.969 feet; width of c nel = b, 15.970 feet; width of broad crest, 8.980 feet.]

1	27	0.3136	0.3116	0.312	11.563	0.040	0.174	0.312	0.469	2.691
2	20	.1596	.1576	.159	11.410	.014	.064	.159	.163	2.570
3	32	.4196	.4176	.419	11.670	.058	.271	.419	.679	2.504
4	20	3.0666	3.0506	3.058	14.309	.986	5.386	3.073	14.105	2.619
5	19	2.3306	2.3116	2.319	13.569	.686	3.547	2.326	9.307	2.624
6	17	2.8656	2.8486	1.856	13.107	.512	2.537	1.860	6.712	2.646
7	31	1.5166	1.5106	1.513	12.763	.386	1.864	1.515	4.928	2.642
8	28	1.2556	1.2506	1.252	12.503	.297	1.404	1.254	3.718	2.649
9	31	1.0396	1.0356	1.038	12.289	.228	1.059	1.039	2.803	2.646
10	29	.8996	.8916	.897	12.148	.186	.850	.897	2.254	2.652
11	26	.7326	.7306	.732	11.983	.140	.627	.732	1.676	2.676
12	32	.5046	.5006	.502	11.753	.083	.356	.502	.971	2.727

ited States Geological Survey experiments at Cornell hydraulic laboratory on model of flat-top weirs with vertical faces—Continued.

ries No. XLV. Height of weir = *P*, 11.25 feet; length of weir crest = *L*, 15.969 feet; width of channel = *b*, 15.970 feet; width of broad crest, 5.875 feet; nappe partly aerated.]

No.	Measured head on experimental weir, in feet.				*A* = area of section per foot of crest.	*v* = mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		*Q* = discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.
	Number of observations.	Maximum.	Minimum.	Mean = *D*.			$H^{\frac{3}{2}}$	*H*		
1	2	3	4	5	6	7	8	9	10	11
1	24	0.1766	0.1726	0.174	11.424	0.018	0.072	0.174	0.207	2.857
2	32	.2566	.2526	.253	11.504	.029	.127	.253	.337	2.647
3	38	.3906	.3886	.390	11.640	.055	.243	.390	.641	2.635
4	31	.9806	.9756	.982	12.233	.209	.975	.983	2.557	2.624
5	31	1.2456	1.2396	1.242	12.492	.293	1.386	1.243	3.666	2.645
6	32	.9126	.9066	.908	12.159	.189	.867	.909	2.294	2.646
7	42	.7846	.7306	.783	11.983	.139	.627	.733	1.670	2.663
8	26	1.0006	.9916	1.996	13.247	.564	2.830	2.001	7.469	2.639
9	33	.5906	.5806	1.585	12.836	.410	2.000	1.587	5.264	2.632
10	23	.5916	.5896	.590	11.841	.103	.454	.590	1.220	2.689
11	36	.5216	.5116	.520	11.771	.087	.376	.521	1.022	2.722

ieries No. XLVI. Height of weir = *P*, 11.25 feet; length of weir crest = *L*, 15.969 feet; width of channel = *b*, 15.970 feet; width of broad crest, 3.174 feet; nappe partly aerated.]

1	26	0.2526	0.2446	0.250	11.501	0.029	0.125	0.250	0.333	2.665
2	41	.1916	.1896	.191	11.441	.019	.083	.191	.221	2.660
3	34	.4186	.4156	.417	11.668	.066	.269	.417	.766	2.845
4	23	2.9686	2.9416	2.965	14.216	1.048	5.147	2.981	14.901	2.895
5	30	2.4956	2.4806	2.486	13.737	.803	3.943	2.496	11.032	2.798
6	32	2.0376	2.0126	2.030	13.280	.594	2.903	2.035	7.895	2.720
7	33	1.6006	1.5906	1.597	12.847	.417	2.022	1.599	5.360	2.650
8	32	1.2326	1.2286	1.232	12.483	.291	1.370	1.231	3.628	2.647
9	32	.9726	.9706	.972	12.222	.208	.959	.972	2.549	2.658
10	31	.7866	.7816	.784	12.035	.154	.695	.785	1.856	2.670
11	38	.6026	.6006	.602	11.852	.106	.467	.602	1.254	2.686
12	33	.5056	.5026	.503	11.751	.082	.357	.503	.967	2.706

N o. XLVII. Height of weir = *P*, 11.25 feet; length of weir crest = *L*, 15.969 feet; width of channel = *b*, 15.970 feet; width of broad crest, 0.927 foot; nappe partly aerated.]

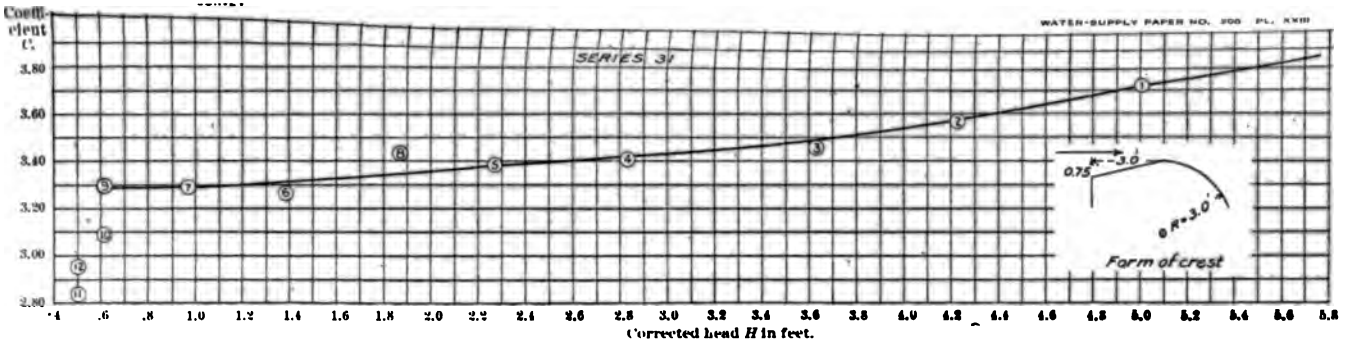
1	27	0.1666	0.1636	0.165	11.416	0.016	0.067	0.165	0.180	2.690
2	29	.2816	.2726	.278	11.529	.033	.147	.278	.377	2.563
3	31	.4156	.4106	.412	11.663	.060	.265	.412	.700	2.644
4	29	2.9446	2.9206	2.933	14.184	1.187	5.076	2.954	16.840	3.318
5	29	2.5306	2.5116	2.522	13.772	.970	4.037	2.535	13.360	3.314
6	26	2.0196	2.0106	2.014	13.264	.722	2.874	2.021	9.572	3.331
7	29	1.5786	1.5706	1.592	12.842	.512	2.015	1.596	6.582	3.266
8	30	1.2296	1.2236	1.226	12.477	.345	1.361	1.228	4.308	3.166
9	27	1.0096	1.0046	1.007	12.258	.248	1.012	1.008	3.046	3.008
10	34	.7786	.7756	.777	12.027	.163	.685	.777	1.965	2.869
11	27	.6296	.6276	.629	11.879	.117	.499	.629	1.389	2.786
12	30	.4616	.4606	.461	11.712	.073	.313	.461	.859	2.741

United States Geological Survey experiments at Cornell hydraulic laboratory on mode Merrimac River dam, at Lawrence, Mass.

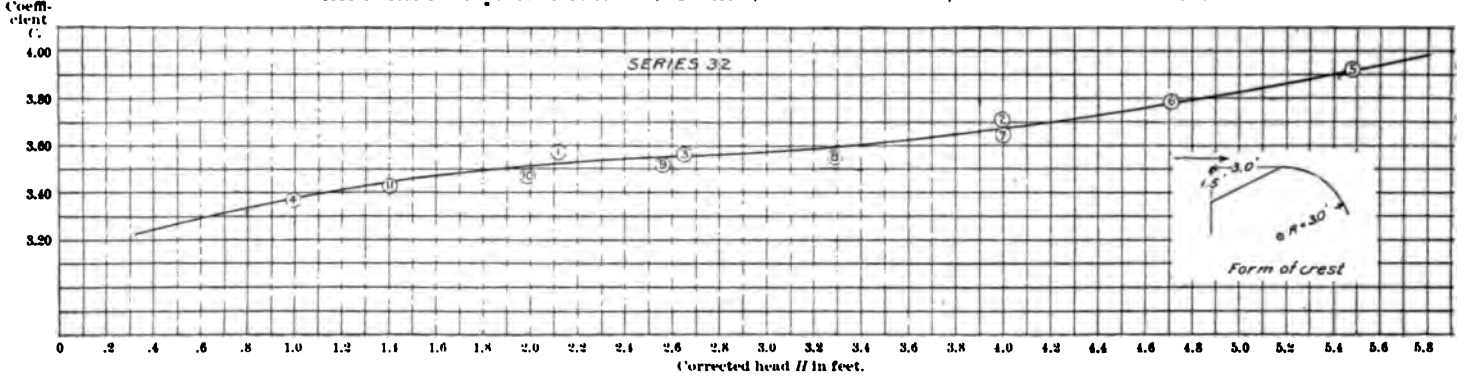
[Height of weir=P, 6.65 feet; length of weir crest=L, 9.999 feet; width of channel=b, 15.97 fe

No.	Measured head on experimental weir, in feet.				A= area of section per foot of crest.	v= mean velocity of approach, in feet per second.	Head corrected for velocity of approach, in feet.		Q=discharge per foot of crest, in cubic feet per second.	Discharge coefficient C_1.
	Number of observations.	Maximum.	Minimum.	Mean=D.			$H^{\frac{3}{2}}$	H		
1	2	3	4	5	6	7	8	9	10	11
1[a]	.....	.....	.....	4.001	10.651	2.618	8.288	4.094	27.893	3.365
2[a]	.....	.....	.....	3.930	10.580	2.563	8.054	4.018	27.120	3.367
3[a]	.....	.....	.....	3.630	10.280	2.309	7.029	3.670	23.740	3.377
21	.....	.....	.....	3.630	10.280	2.319	7.029	3.670	23.738	3.377
10	.....	.....	.....	3.166	9.816	1.939	5.769	3.216	19.039	3.300
11	.....	.....	.....	2.815	9.465	1.654	4.837	2.860	15.660	3.237
22	.....	.....	.....	2.510	9.160	1.424	4.067	2.548	13.049	3.208
23	.....	.....	.....	2.223	8.873	1.200	3.361	2.244	10.652	3.169
12	.....	.....	.....	2.130	8.780	1.127	3.150	2.149	9.898	3.142
1	.....	.....	.....	2.041	8.691	1.066	2.983	2.049	9.265	3.158
24	.....	.....	.....	1.850	8.500	.932	2.542	1.868	7.929	3.113
2	.....	.....	.....	1.746	8.396	.860	2.327	1.756	7.227	3.105
3	.....	.....	.....	1.645	8.295	.802	2.302	1.743	6.651	2.889
13	.....	.....	.....	1.496	8.146	.691	1.832	1.497	5.631	3.074
4	.....	.....	.....	1.322	7.972	.600	1.528	1.327	4.791	3.135
25	.....	.....	.....	1.268	7.918	.556	1.434	1.272	4.410	3.075
5	.....	.....	.....	1.089	7.739	.462	1.141	1.092	3.581	3.138
6	.....	.....	.....	.764	7.414	.284	.669	.765	2.108	3.151
7	.....	.....	.....	.584	7.234	.195	.447	.585	1.412	3.158
9	.....	.....	.....	.583	7.233	.192	.446	.584	1.389	3.114
19	.....	.....	.....	.198	6.848	.039	.088	.198	0.270	3.067

In the accompanying tables (pp. 98–106), columns 2, 3, and 4 sho respectively, the number of observations of head and the maximu and minimum readings in each experimental period. In column 5 given the mean head on the experimental weir deduced from the ta observations above described. Column 6 shows the area of cross se tion of the channel of approach per foot of crest. For suppresse weirs this quantity equals the sum of the height of weir plus th measured depth on crest. For weirs with one end contraction th quantity A is obtained by dividing the total area of the water section where D is measured, by the net length of the weir crest correcte for the end contraction. For those series where the depth on th experimental weir was increased by contracting the weir to about on half of the channel width and introducing one end contraction, th net length of crest has been determined by the method of Francis, b deducting one tenth the head from the measured length of crest. Th discharge per foot of crest of the experimental weir given in colun 10 has been deduced from the discharge over the standard we

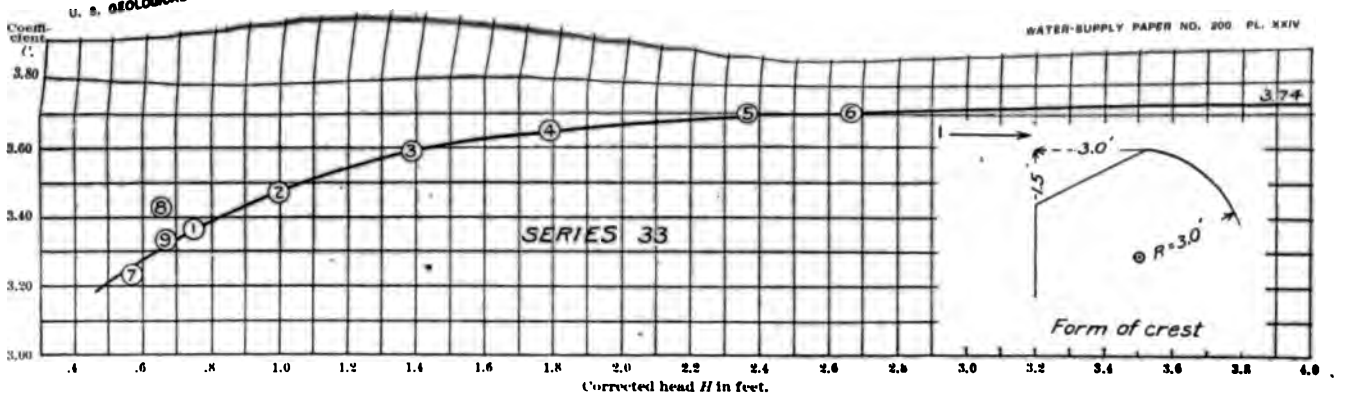


MODEL OF OGEE DAM OF LOZIER MOTOR COMPANY, PLATTSBURG, N. Y. LENGTH OF CREST, 7.938 FEET. ONE END CONTRACTION.

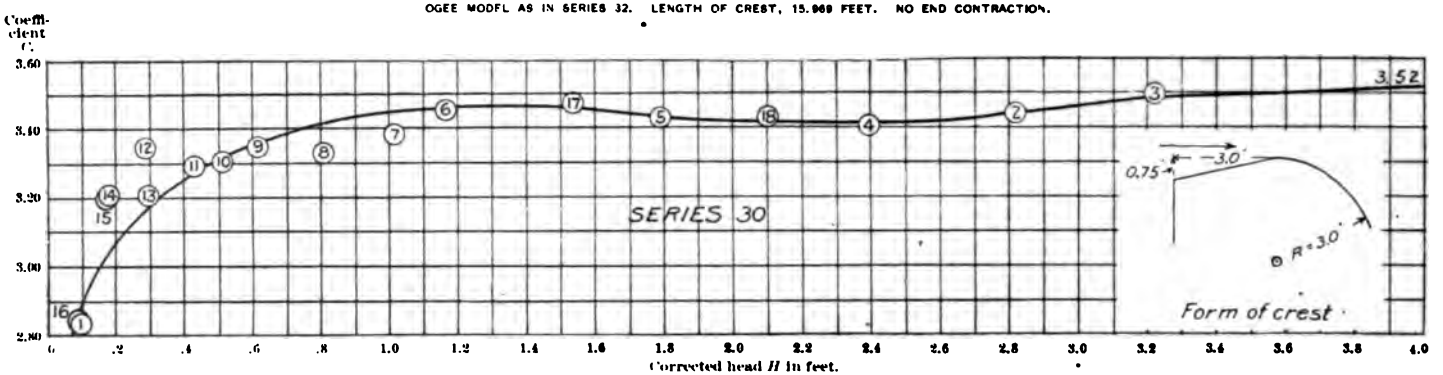


MODEL SIMILAR TO PLATTSBURG DAM, WITH BACK SLOPE MODIFIED. LENGTH OF CREST, 7.979 FEET. ONE END CONTRACTION.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.

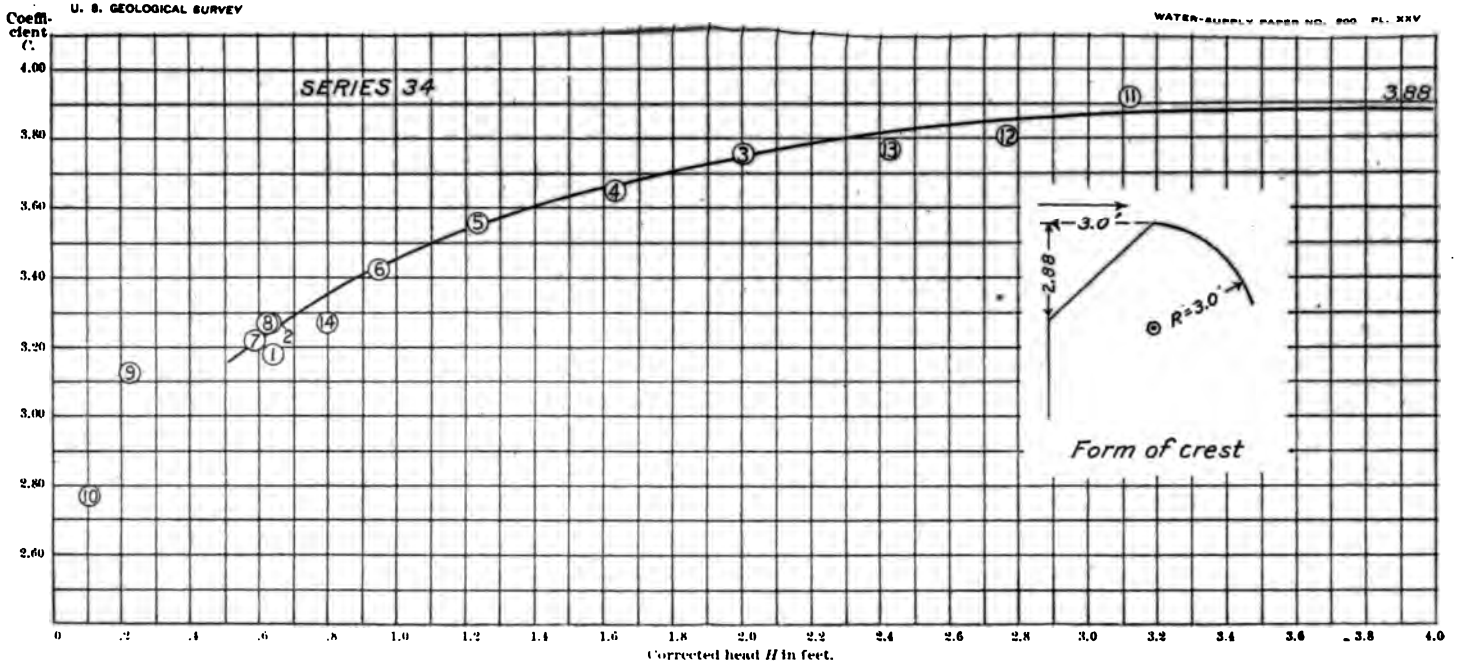


OGEE MODEL AS IN SERIES 32. LENGTH OF CREST, 15.969 FEET. NO END CONTRACTION.



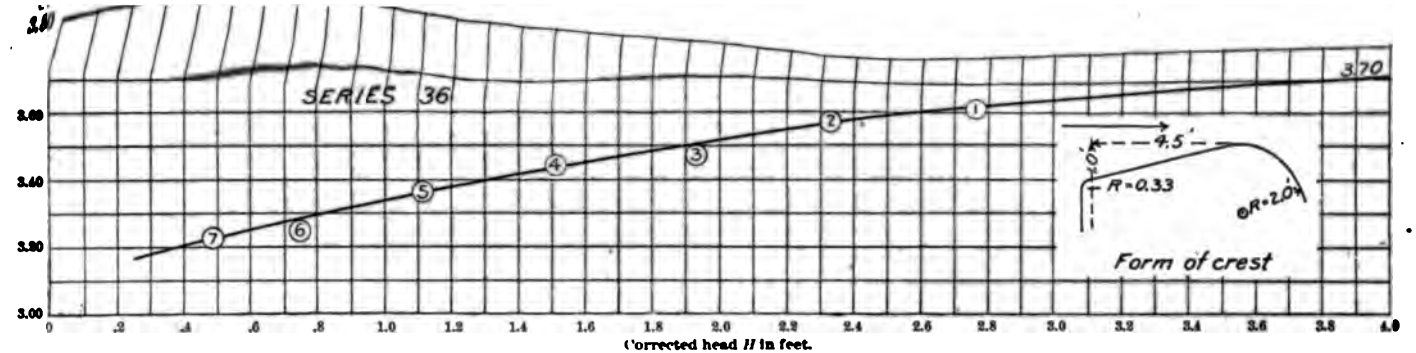
MODEL OF OGEE DAM OF LOZIER MOTOR COMPANY, PLATTSBURG, N. Y. LENGTH OF CREST, 15.969 FEET.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903

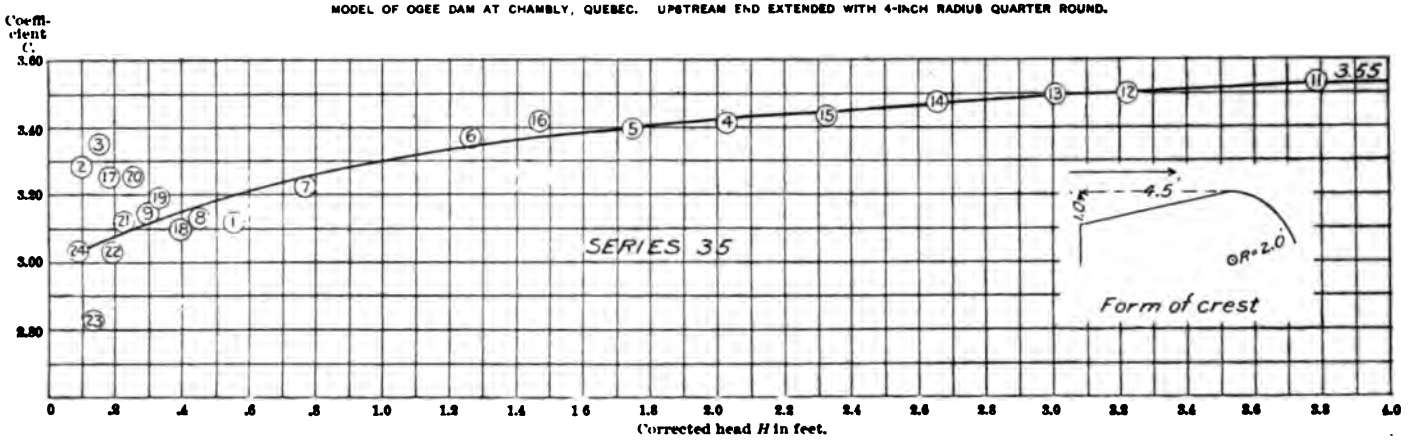


OGEE MODEL SIMILAR TO PLATTSBURG DAM, WITH BACK SLOPE MODIFIED. LENGTH OF CREST, 15.969 FEET.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.

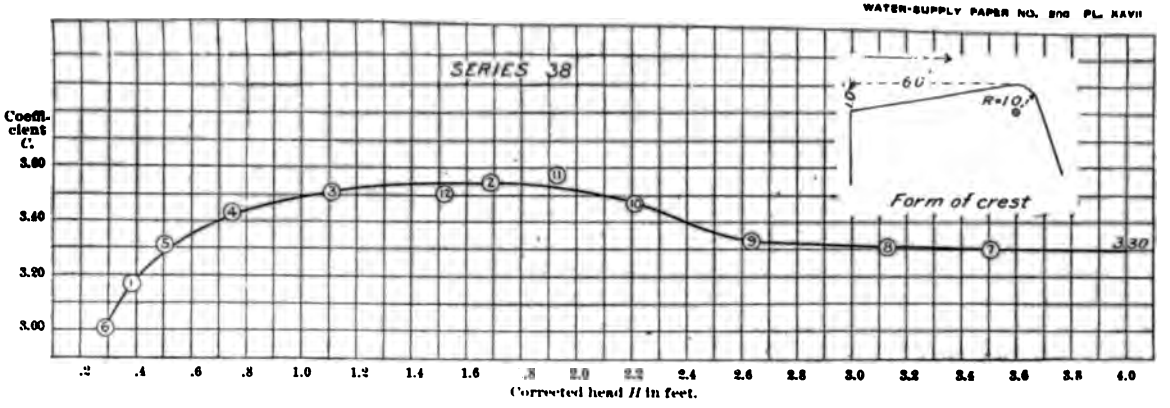


MODEL OF OGEE DAM AT CHAMBLY, QUEBEC. UPSTREAM END EXTENDED WITH 4-INCH RADIUS QUARTER ROUND.

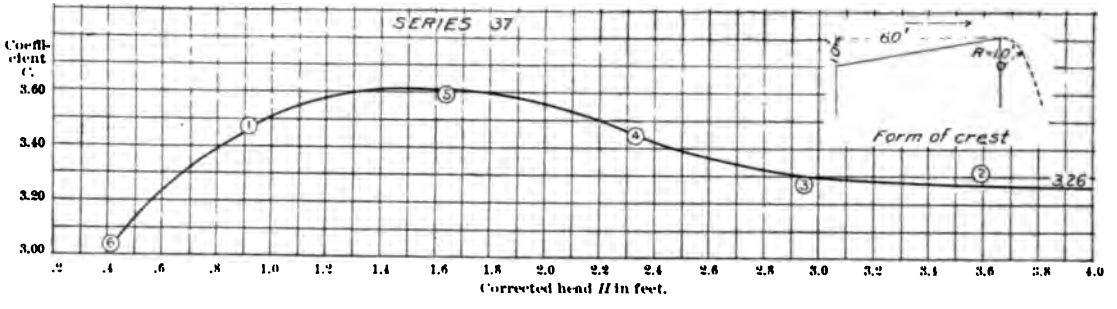


MODEL OF OGEE DAM AT CHAMBLY, QUEBEC. LENGTH OF CREST, 15.960 FEET.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.

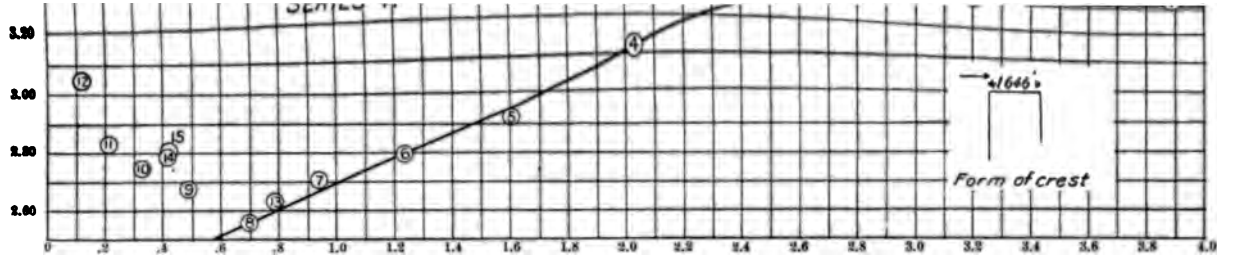


MODEL OF OGEE DAM AT DOLGEVILLE, N. Y. LENGTH OF CREST, 15.969 FEET.

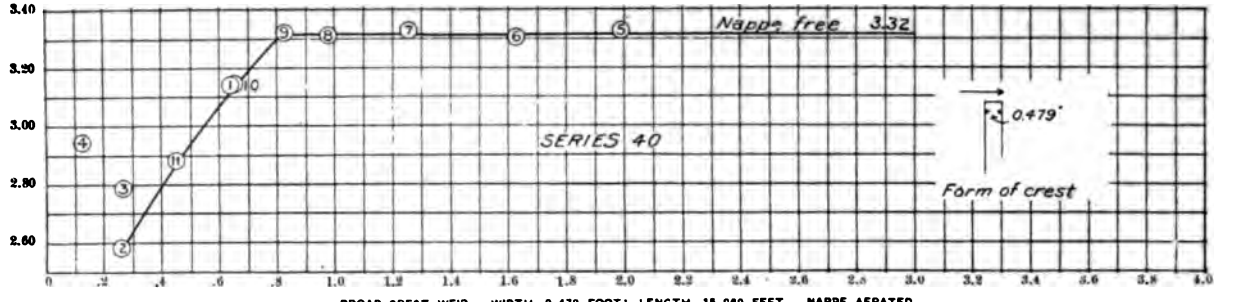


MODEL OF OGEE DAM AT DOLGEVILLE, N. Y. PART OF APRON CARRIED AWAY IN SECOND EXPERIMENT. LENGTH OF CREST, 15.969 FEET.

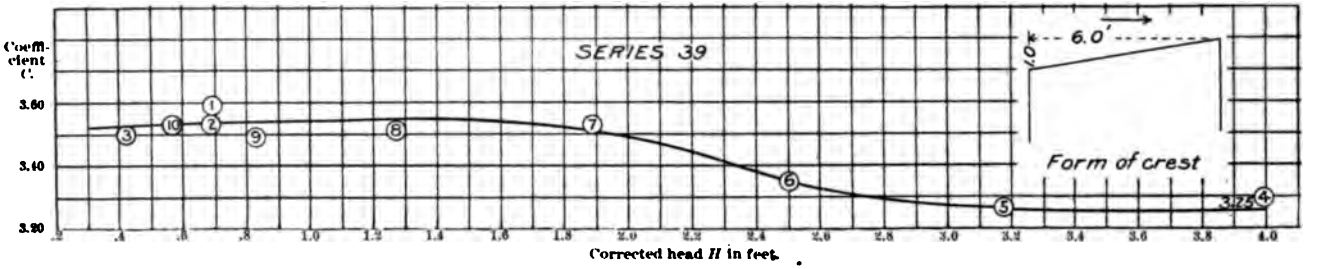
EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.



BROAD-CREST WEIR. WIDTH, 1.646 FEET; LENGTH, 15.969 FEET. NAPPE PARTLY AERATED.

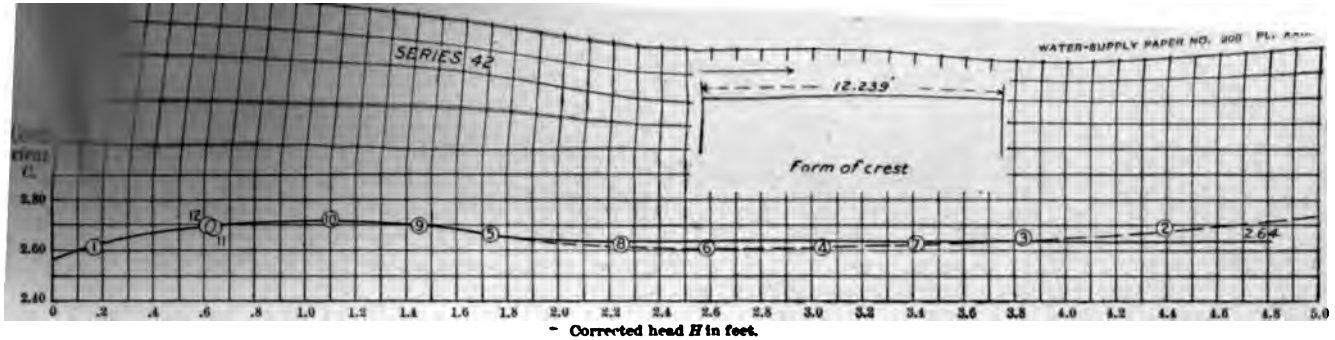


BROAD-CREST WEIR. WIDTH, 0.479 FOOT; LENGTH, 15.969 FEET. NAPPE AERATED.



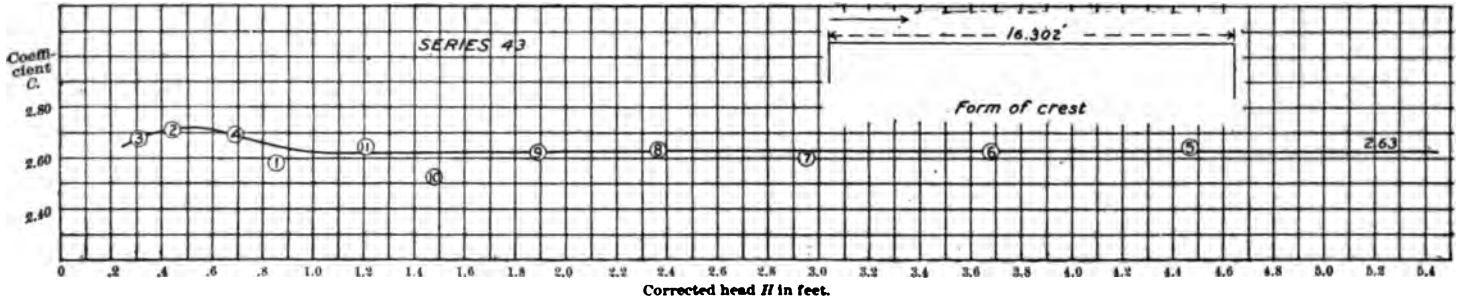
MODEL OF DOLGEVILLE DAM WITH APRON REMOVED, LEAVING TRAPEZOID. LENGTH OF CREST, 15.969 FEET. NAPPE AERATED.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.



Corrected head H in feet.

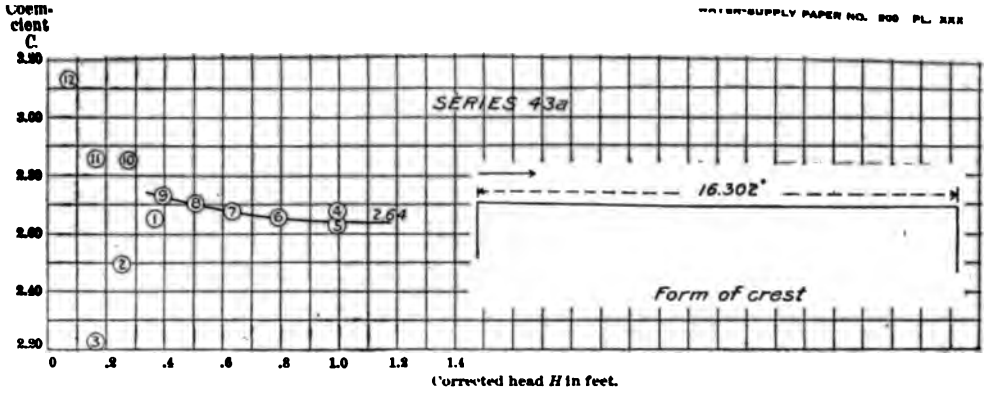
BROAD-CREST WEIR. WIDTH, 12.239 FEET; LENGTH, 18.969 FEET. NAPPE PARTLY AERATED.



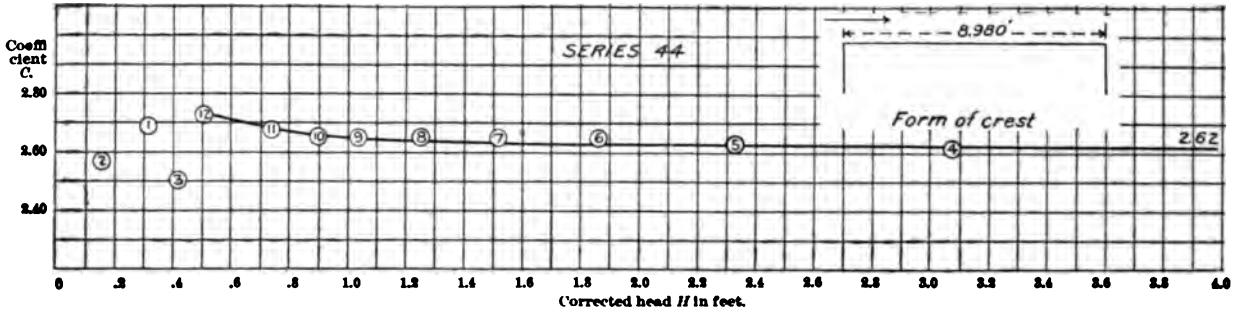
Corrected head H in feet.

BROAD-CREST WEIR. WIDTH, 16.302 FEET; LENGTH, 18.969 FEET. EDGES OF TRANSVERSE BOARDS NOT FLUSH; NAPPE PARTLY AERATED.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.



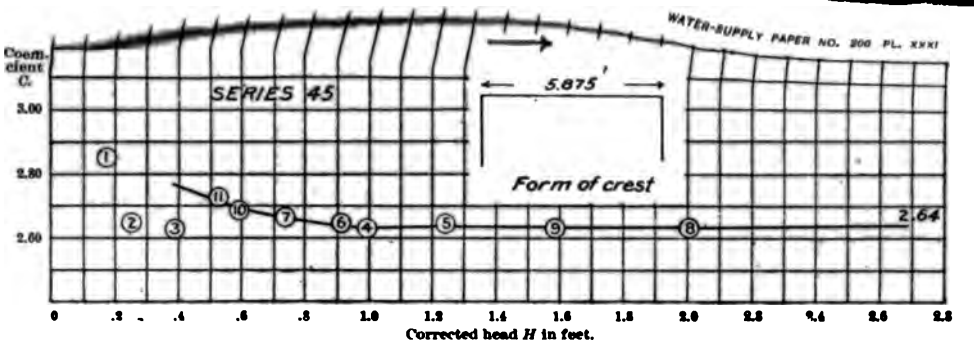
BROAD-CREST WEIR. WIDTH, 16.302 FEET; LENGTH, 15.960 FEET. SMOOTH CREST SURFACE; NAPPE PARTLY AERATED.



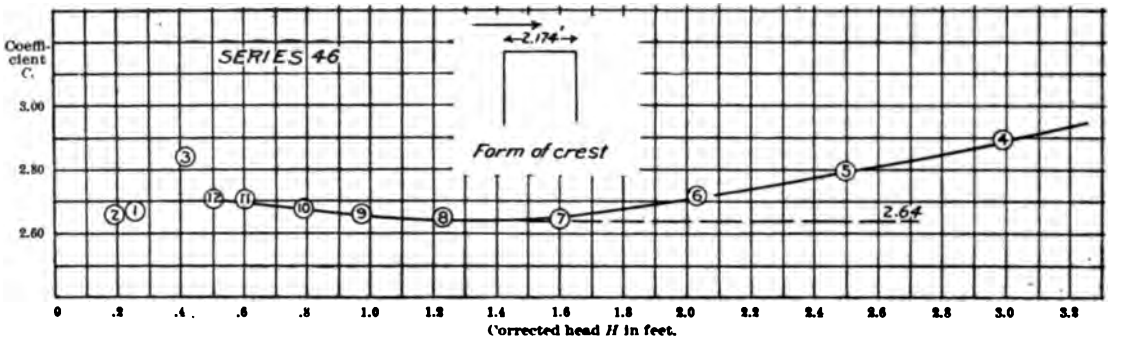
BROAD-CREST WEIR. WIDTH, 8.980 FEET; LENGTH, 15.960 FEET. NAPPE PARTLY AERATED.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.

U. S. GEOLOGICAL SURVEY

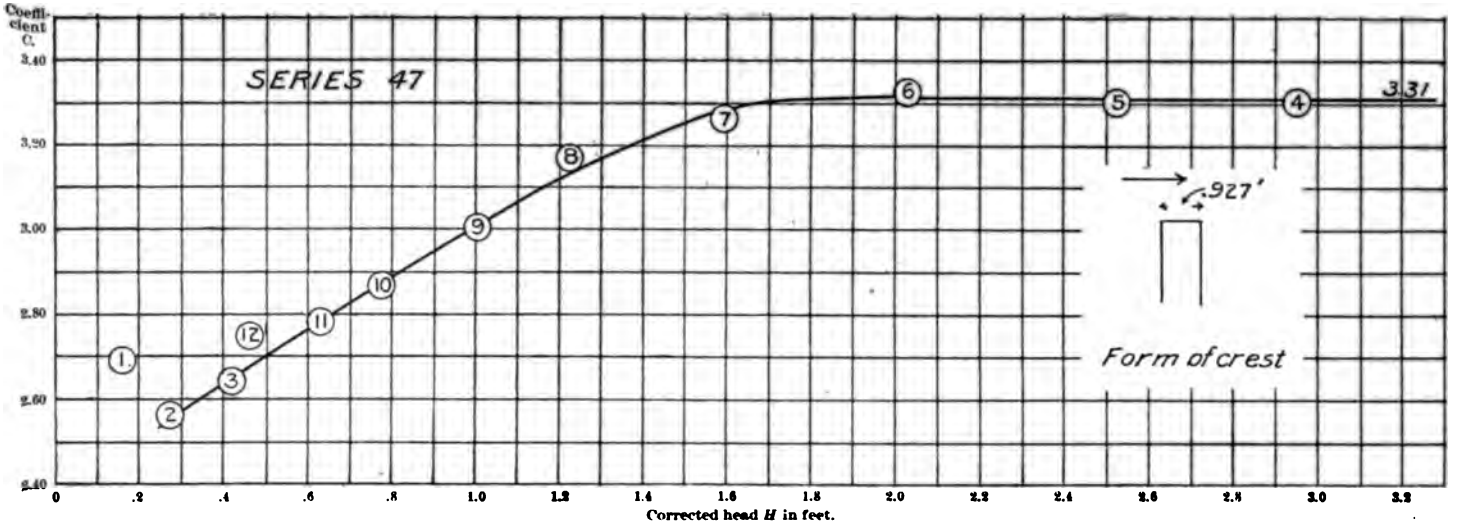


BROAD-CREST WEIR. WIDTH, 5.875 FEET; LENGTH, 15.960 FEET. NAPPE PARTLY AERATED.



BROAD-CREST WEIR. WIDTH, 2.174 FEET; LENGTH, 15.960 FEET. NAPPE PARTLY AERATED.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.



BROAD-CREST WEIR. WIDTH, 0.927 FOOT; LENGTH, 15.969 FEET. NAPPE PARTLY AERATED.

EXPERIMENTS OF UNITED STATES GEOLOGICAL SURVEY ON VOLUME OF FLOW OVER MODEL DAMS, CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.

obtained, as described above, by dividing the total discharge by the net length of the experimental weir. The mean velocity of approach v, given in column 7, has been obtained by the formula

$$v=\frac{Q}{A}.$$

The correction for velocity of approach has been carefully computed by the Francis formula

$$H^{\frac{3}{2}}=(D+h)^{\frac{3}{2}}-h^{\frac{3}{2}},$$

where

$$h=\frac{v^2}{2g}.$$

The resulting values of $H^{\frac{3}{2}}$ are given in column 8. The corresponding values of H, given in column 9, have been obtained by interpolation from a table of three-halves powers. The discharge coefficient C_1 given in column 11 has been obtained by the formula

$$C_1=\frac{Q}{H^{\frac{3}{2}}}.$$

This coefficient represents the discharge per linear foot of crest, if the head is 1 foot, with no velocity of approach, it being the coefficient in a weir formula of the same form as that used by J. B. Francis for a thin-edged weir.

Pls. XXIII to XXXII show the coefficient diagrams deduced from these experiments.

EXPERIMENTS ON MODEL OF DAM OF THE ESSEX COMPANY, MERRIMAC RIVER, AT LAWRENCE, MASS.[a]

A series of experiments covering five different depths on crest was made by James B. Francis at lower locks, Lowell, Mass., November, 1852. The model had a crest length of 9.999 feet, with end contractions suppressed. Height of water was measured by hook gage in a chamber at one side of the channel, 6 feet upstream from crest, so arranged as to give substantially the height of the still-water surface above the crest without correction for velocity of approach. The discharge was volumetrically determined as in Francis's thin-edged weir experiments.

The experiments of Francis covered depths on crest ranging from 0.5872 foot to 1.6338 feet. From these experiments he deduced the formula for discharge,

$$Q=3.01208LH^{1.53}.$$

[a] Francis, J. B., Lowell Hydraulic Experiments, pp. 136–137.

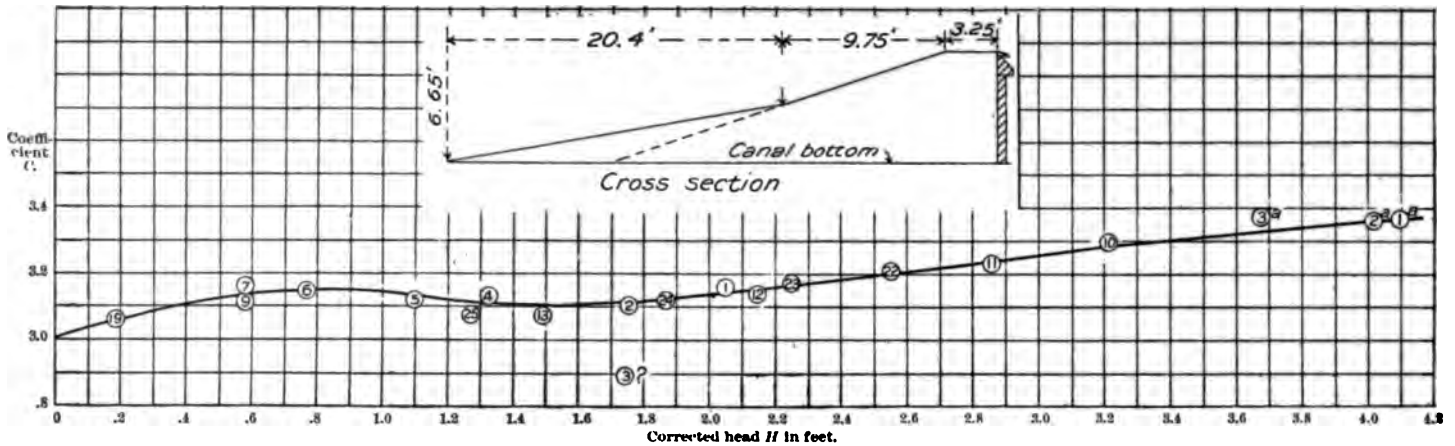
If the discharge were expressed in terms of the usual formula, $Q = C_1 L H^{\frac{3}{2}}$, with a varying coefficient C_1, we should have a continuously increasing coefficient.

A series of experiments on a similar model dam, 6.65 feet high, with crest length of 15.932 feet, was made at Cornell University hydraulic laboratory in 1903. The model there used differed from that shown by Francis only in the substitution of a flatter upstream slope near the bottom of the canal, as shown in Pl. XXXIII. The end contractions were suppressed and the depth on crest was measured with steel tape and plumb bob suspended over center of channel at points 14.67 feet and 29.82 feet, respectively, upstream from crest of experimental weir. Discharge was previously measured over the standard weir, calibrated by Bazin's and Fteley and Stearns's formulas, located at head of experimental canal.

The experiments covered a range of heads varying from 0.198 foot to 4.94 feet. In the majority of the experiments the head was observed at both points. The upper point of measuring depth was at the upstream end of the inclined approach. The lower point was over the incline, where the area of the section of approach was smaller and the velocity larger than in the deeper channel above. The experiments have been reduced with reference to the heads measured 29.82 feet upstream from crest. By comparison of the depths simultaneously observed at the two points correction factors have been deduced for the reduction of the remaining experiments, in which the head was observed at the downstream point of observation only.

The observed head has been corrected for velocity of approach by the formula of Francis. The resulting mean coefficient curve, based on 19 valid observations, shows a larger coefficient of discharge in the formula $Q = C_1 L H^{\frac{3}{2}}$ than does that of Francis.

For a head of 1 foot the formula of Francis for the Merrimac dam gives a discharge of 90.3 per cent of that for a thin-edged weir. The Cornell experiments show 94.5 per cent of the discharge over a thin-edged weir under the same head.



EXPERIMENTS ON MODEL SIMILAR TO MERRIMAC RIVER DAM AT LAWRENCE, MASS., MADE FOR UNITED STATES GEOLOGICAL SURVEY AT CORNELL UNIVERSITY HYDRAULIC LABORATORY, 1903.

Discharge per foot of crest, Francis formula for Merrimac dam, compared with Cornell experiments on similar cross section.

Depth on crest, H.	Q per foot of crest, in cubic feet per second, Francis.	Coefficient C_1 in formula $Q = C_1 L H^{\frac{3}{2}}$.		Depth on crest, H.	Q per foot of crest, in cubic feet per second, Francis.	Coefficient C_1 in formula $Q = C_1 L H^{\frac{3}{2}}$.	
		Francis's formula.	Cornell experiments.			Francis's formula.	Cornell experiments.
0.15	0.1653	2.845	3.05	0.85	2.3490	2.997	.....
.20	.2567	2.871	3.06	.90	2.5636	3.002	3.15
.25	.3611	2.889	3.07	.95	2.7846	3.007	3.15
.30	.4774	2.905	3.08	1.00	3.0121	3.012	3.15
.35	.6043	2.913	3.09	1.15	3.7500	3.041	3.13
.40	.7431	2.937	3.11	1.25	4.2378	3.033	3.12
.45	.8877	2.940	3.12	1.50	5.6012	3.048	3.10
.50	1.0430	2.940	3.13	1.75	.....	.....	3.12
.55	1.206	2.956	3.135	2.00	8.6975	3.075	3.14
.60	1.379	2.966	3.14	2.50	.....	.....	3.20
.65	1.5581	2.973	3.14	3.00	16.1750	3.113	3.26
.70	1.7452	2.980	3.14	3.50	.....	.....	3.31
.75	1.9395	2.986	3.14	4.00	25.1200	3.140	3.36
.80	2.1408	2.992	3.15				

Aside from Blackwell's experiments the Francis formula for the Merrimac dam was until recently the only one available for a large dam of irregular section, and for want of more appropriate data it has been used for the calculation of discharge over many forms of weirs of irregular section, and in spite of Francis's explicit caution, it has been applied where the heads differed widely from those used in the original experiments.

Considering the limited experiments on which it is based, Francis's Merrimac dam formula gives good agreement with the much more extended experiments on a similar section made at Cornell hydraulic laboratory.

FLOW OVER WEIRS WITH BROAD CRESTS.

THEORETICAL FORMULA OF UNWIN AND FRIZELL.[a]

Consider a weir of such breadth that the nappe becomes of sensibly uniform depth in the portion BC, fig. 8, the upstream corner of the weir being rounded to prevent vertical contraction and the surface slightly inclined downstream so that it becomes parallel with the surface of the nappe BC.

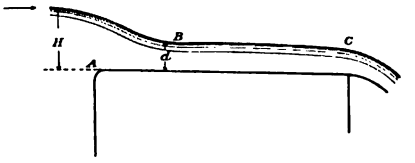


FIG. 8.—Broad-crested weir.

The fall causing the velocity V in the section BC is $H-d$. It follows that if v is the mean velocity in BC

$$v=\sqrt{2g(H-d)} \qquad Q=Ldv=Ld\sqrt{2g(H-d)}$$

In this equation Q is 0 when $d=0$ or $d=H$. There must, therefore, be an intermediate value of d for which Q will be a maximum. Differentiating we find for the condition of a maximum,

$$\frac{dQ}{dd}=0=L\sqrt{2g}\left[\sqrt{H-d}-\frac{1}{2}\frac{d}{\sqrt{H-d}}\right]$$

Giving $H-d=\frac{d}{2}$ and $d=\frac{2}{3}H$, or, for maximum discharge, one-third the head would be expended in producing the velocity of flow. With this value of d the expression for discharge becomes

$$\left.\begin{aligned} &Q=\frac{2}{3}\frac{LH}{\sqrt{3}}\sqrt{2gH}=0.38490LH\sqrt{2gH} \\ \text{or if}\quad &\sqrt{2g}=8.02, \\ &Q=3.087LH^{\frac{3}{2}} \end{aligned}\right\} \quad . \quad . \quad . \quad . \quad (58)$$

In this formula frictional resistance has been neglected. The discharge given is the maximum for the conditions, and would result only if the stream discharges itself in accordance with the "principle of least energy."

Blackwell's experiments, given elsewhere, show a considerably larger coefficient for weirs 3 feet broad, slightly inclined downward, than for those with horizontal crests.

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[a] W. C. Unwin, in article 1 on Hydrodynamics in Ency. Brit. Independently derived by [illegible] See his Water Power, pp. 198-200.

Let $d=KH$, then from the formula first given

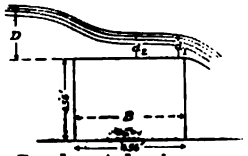
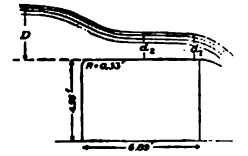
$$Q=LKH\sqrt{2gH(1-K)}$$
$$=K\sqrt{2g(1-K)}LH^{\frac{3}{2}}$$

$$C_1=8.02K\sqrt{1-K} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (59)$$

The theoretical coefficient C_1 can be computed from this equation if K has been determined experimentally.

From profiles taken in connection with United States Deep Waterways experiments at Cornell University hydraulic laboratory in 1899 the following values of D and d for broad-crested weirs have been scaled and the ratio $d:D$ computed. D was taken 4 feet upstream from the upper face of the weir, and does not include velocity of approach correction; values of d_1 and d_2 were taken at the lower-crest lip and center of crest, respectively. The value of d_2 at center of crest has been used in the computations.

Values of D and d for broad-crested weirs.

		D	d_1	d_2	$K=\frac{d_2}{D}$
 Broad-crested weir.	1	0.90	0.35	0.52	0.58
	2	1.15	.45	.68	.59
	3	1.80	.75	1.14	.63
	4	2.60	1.20	1.75	.67
	5	3.55	1.72	2.52	.71
	6	5.15	2.20	3.15	.61
 Broad-crested weir.	1	1.00	.35	.50	.50
	2	1.32	.53	.70	.50
	3	1.98	.75	.98	.50
	4	2.85	1.08	1.70	.60
	5	3.90	1.50	2.50	.64
	6	4.65	2.10	3.10	.61

For low heads a sudden drop begins near the upstream crest corner and terminates at a distance 1.5 to 2 D below the upstream corner. From this point to within a distance about equal to D from the downstream crest corner the surface is nearly parallel with the crest. If the width of crest is not greater than 2.5 to 3 D the nappe passes over the broad crest in a continuous surface curve, becoming more nearly convex as the ratio $D:B$ increases.

For low heads Cornell experiment 13, crest 6.56 feet wide, with rounded upstream corner, complies very well with the theory of dis-

charge in accordance of the principle of least energy. The coefficient computed as above is

$$C_1 = 8.02 \times 0.585\sqrt{1-0.585}$$
$$= 8.02 \times 0.585 \times 0.6442$$
$$= 3.02$$

The experimental coefficient with head corrected for velocity of approach is 2.82.

The following additional data may be cited:

Trautwine[a] quotes data of Elwood Morris, C. E., for Clegg's dam, Cape Fear River, North Carolina. Horizontal crest 8.42 feet wide, vertical faces. $H=1.25$ feet. d (throughout central portion of crest) $=0.50$ foot. $d/H=0.40$.

Thos. T. Johnston[b] gives data of elaborate profiles of the nappe for Desplaines River dam, Illinois. Horizontal planed stone coping, vertical downstream face; upstream face batter, 1/2:1. $H=0.587$ foot. $d=0.315$ to 0.307 foot in central, nearly level portion at distances 1.5 to 4 feet from upstream edge of crest. Johnston and Cooley deduce the coefficient $C=1.69$ for this case.

BLACKWELL'S EXPERIMENTS ON DISCHARGE OF WATER OVER BROAD-CRESTED WEIRS.

Experiments made by Thomas E. Blackwell,[c] M. Inst. C. E., are of interest as being probably the first recorded for weirs with broad crests. The discharge was volumetrically measured, and the conditions were generally favorable to accuracy. The experiments were made on a side pond of the Kennet and Avon Canal, 106,200 square feet surface area, closed by a lock at each end, the water being admitted from time to time as required, the relation between area of reservoir and volume of discharge being such that there was no sensible variation in water level during an experiment.

The weir was constructed in a dock to which the water had access through an irregularly shaped channel 40 feet in width, cut off from the main pond by a submerged masonry wall 9 feet wide, situated 25 feet upstream from the weir, having its top 18 inches to 20 inches below water surface.

The water level in the pond being constant when outflow took place, the weir, which had a crest adjustable in a vertical plane, was set with its crest level at the depth below water surface desired for an experiment, by means of adjusting screws at the ends of the weir; the water

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[a] Engineers' Pocket Book.

[b] Johnston, T. T., and Cooley, E. L., New experimental data for flow over a broad-crest dam: Jour. Western Soc. Engrs., vol. 1, Jan., 1896, pp. 30–51.

[c] Original paper before Institution of Civil Engineers of London, reprinted in the Journal of the Franklin Institute, Philadelphia, March and April, 1852.

was then allowed to waste through the weir until a uniform regimen of flow was established.

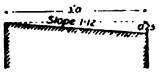
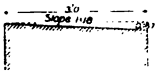
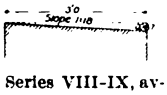
A gaging tank having a floor of brick laid in cement, with plank sides, and 449.39 cubic feet capacity, was erected at the foot of the weir. At a given signal the lid of this tank was raised, the time noted, and the rate of filling of the tank recorded by several observers. Such leakage from the tank as occurred was separately measured and allowed for. There was no correction for velocity of approach or for end contractions.

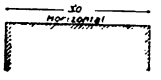
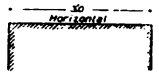
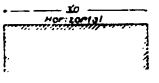
The wind was so slight as to be negligible, except during one series when there was a brisk wind blowing downstream. The experimenter states that parallel experiments on a quiet day indicated an increase of about 5 per cent in discharge due to this wind.

The crest of the thin-edged weir consisted of an iron plate barely one-sixteenth inch thick. A square-top plank 2 inches thick was attached to the weir, and an apron of deal boards, roughly planed so as to form an uninterrupted continuation downstream, constituted the wide-crested weir used in the experiments.

The coefficient C_1 from Blackwell's experiments has been worked out and is given in the following table. The measured depths taken in inches have also been reduced to feet.

Blackwell's experiments on broad-crested weirs, Kennet and Avon Canal, England, 1858.

Weir.	Measured head, in inches.	Head, in feet.	Q per foot, in cub. ft. per sec.	M	$C_1 = M\sqrt{2g}$
II. Thin plate, 10 feet long.	1	0.083	0.104	0.539	4.32
	2	.167	.292	.535	4.29
	3	.25	.429	.428	3.43
	4	.333	.675	.437	3.50
	5	.417	.935	.433	3.47
	8	.667	1.691	.387	3.10
	9	.750	1.842	.353	2.83
VII. L=3 feet. 	1	.083	.060	.311	2.49
	2	.167	.194	.355	2.85
	3	.250	.360	.359	2.88
	4	.333	.468	.303	2.43
	6	.500	1.005	.354	2.84
	7	.583	1.254	.351	2.82
	9	.750	1.729	.332	2.66
Series VII, average					2.71
VII'. L=3 feet. 	1	.083	.070	.363	2.91
	2	.167	.199	.364	2.92
	3	.250	.359	.358	2.87
	4	.333	.443	.287	2.30
	5	.417	.743	.344	2.76
	7	.583	1.222	.342	2.74
	8	.667	1.426	.327	2.62
	9	.750	1.709	.328	2.63
IX. L=10 feet. 	1 to ¾	.073	.060	.311	2.49
	2	.167	.181	.330	2.65
	4	.333	.530	.343	2.75
	6	.500	1.028	.362	2.90
	8	.667	1.476	.338	2.71
Series VIII-IX, average					2.71

Weir.	Measured head, in inches.	Head, in feet.	Q per foot, in cub. ft. per sec.	M	$C_1 = M\sqrt{2g}$
X. L=3 feet. 	1	0.083	0.058	0.301	2.41
	2	.167	.175	.321	2.57
	3	.250	.295	.294	2.36
	4	.333	.431	.279	2.24
	5	.417	.689	.319	2.56
	6	.500	.947	.334	2.68
	7	.583	1.162	.325	2.61
	8	.667	1.369	.313	2.51
	9	.750	1.642	.317	2.54
XI. L=6 feet. 	1 to 1½	.093	.071	.....	.....
	3	.250	.329	.328	2.63
	4	.333	.511	.331	2.65
	6	.500	.963	.....	.....
	7	.583	1.191	.331	2.65
	9	.750	1.670	.....	.....
	10	.883	1.895	.310	2.49
	12	1.0	2.495	.311	2.49
XII. L=10 feet. 	1	.083	.049	.254	2.04
	2	.167	.174	.319	2.56
	5	.417	.745	.345	2.77
	6	.500	.972	.312	2.74
	8	.667	1.362	.312	2.50
	9	.750	1.688	.324	2.60
	10	.833	1.847	.308	2.45
Series X, XI, XII, average					52.08 / 2.48

EAST INDIAN ENGINEERS' FORMULA FOR BROAD-CRESTED WEIRS.[a]

This formula is

$$Q=\frac{2}{3}M'LH\sqrt{2gH}, \text{ or if } \sqrt{2g}=8.02,\ Q=5.35\,M'LH^{\frac{3}{2}}=C_1LH^{\frac{3}{2}} \quad (60)$$

Where M'=coefficient for thin-edged weir[b]$=0.654-0.01H$,

$$M'=M-\frac{0.025M(B+1)}{H+1} \quad . \quad . \quad . \quad . \quad . \quad (61)$$

[a] Mullins, Gen. Joseph, Irrigation Manual, Madras, 1890.

[b] See table giving values of M and equivalent values of C, p. 22.

Experimental data not given. This formula gives values of M' or C_1 decreasing as breadth of crest B increases, and for low heads increasing to a maximum for a head of about 1 foot, then slowly decreasing.

The formula reduces to

$$C_1 = C\left(\frac{H+1-0.025\ (B+1)}{H+1}\right) = RC \quad . \quad . \quad . \quad (62)$$

For $B=0$

$$C_1 = C\frac{H+0.975}{H+1} = RC$$

which differs by the ratio R from the equivalent value of C for a thin-edged weir.

Values of coefficient C_1 of discharge over a broad-crested weir and of R, the ratio of the former to C the coefficient of discharge over a thin-edged weir, by Mullins's formula.

B / H, feet.	1 foot.		2 feet.		3 feet.		4 feet.	
	R	C_1	R	C_1	R	C_1	R	C_1
1	0.975	3.359	0.962	3.316	0.95	3.319	0.938	3.230
2	.988	3.335	.975	3.307	.967	3.279	.958	3.251
3	.988	3.296	.981	3.275	.975	3.255	.969	3.234
4	.990	3.253	.985	3.237	.98	3.220	.975	3.204
5	.992	3.204	.988	3.191	.983	3.177	.979	3.164
6	.993	3.155	.989	3.144	.986	3.132	.982	3.121
7	.994	3.104	.991	3.095	.988	3.085	.984	3.075
8	.994	3.054	.992	3.045	.989	3.037	.986	3.028
9	.995	3.003	.992	2.995	.99	2.988	.988	3.042
10	.995	2.950	.993	2.944	.991	2.937	.989	2.930

B / H, feet.	5 feet.		6 feet.		7 feet.		8 feet.	
	R	C_1	R	C_1	R	C_1	R	C_1
1	0.925	3.182	0.912	3.144	0.9	3.100	0.888	3.057
2	.95	3.22	.942	3.194	.933	3.166	.925	3.138
3	.962	3.213	.956	3.192	.95	3.171	.944	3.150
4	.97	3.193	.965	3.171	.96	3.154	.955	3.138
5	.975	3.149	.971	3.137	.967	3.123	.962	3.110
6	.978	3.11	.975	3.098	.971	3.080	.968	3.076
7	.981	3.06	.978	3.057	.975	3.046	.972	3.036
8	.983	3.017	.980	3.012	.977	2.999	.975	2.994
9	.985	2.97	.982	2.966	.98	3.019	.978	2.950
10	.986	2.92	.984	2.916	.982	2.910	.979	2.093

The values of C_1 given in the above table have been deduced from the corresponding values of C for a thin-edged weir by Mullins's formula. The ratio R may, if desired, be applied approximately to correct values of C derived from other standard weir formulas.

FTELEY AND STEARNS EXPERIMENTS ON BROAD-CRESTED WEIRS.[a]

The formula of Fteley and Stearns is based on five series of experiments made in the Sudbury River conduit, Boston, 1877, on weirs 2, 3, 4, 6, and 10 inches wide, respectively. Suppressed weirs 5 feet long were used, the depths being as follows:

Fteley and Stearns experiments.

Width of crest, in inches.	Number of experiments.	Range of depth observed on broad crests, in feet.	
		From—	To—
2	7	0.1158	0.2926
3	21	.1307	.4619
4	25	.1318	.6484
6	22	.1320	.8075
10	17	.1352	.8941

The results are given by the authors in the form of a table of corrections to be added algebraically to the measured head for the broad crested weir to obtain the head on a thin-edged weir that would give the same discharge.

Fteley and Stearns's correction c may be found approximately from the formula

$$c=0.2016\sqrt{[(0.807\ B-H)^2+0.2146\ B^2]}-0.1876\ B \quad . \quad (6$$

or if $k=0.2016$, $m=0.1876$, $n=0.2146$, $O=0.807$, then

$$Q=CL[H-mB+k\sqrt{(OB-H)^2+nB^2}]^{\frac{3}{2}} \quad . \quad . \quad . \quad (6$$

If the head on a broad-crested weir is H, the discharge will be

$$Q=CL(H+c)^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (6$$

C being the coefficient of discharge for thin-edged weirs.

If C_1 is the coefficient for the broad weir, then we may also wr

$$Q=C_1LH^{\frac{3}{2}}.$$

Hence

$$\frac{C_1}{C}=\left(\frac{H+c}{H}\right)^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad .$$

From formula (66) have been calculated Fteley and Stearns' cients for weirs with nappe adhering to crest for use in the fo

$$Q=C'LH^{\frac{3}{2}}.$$

[a] Fteley and Stearns, Experiments on the flow of water, etc.: Trans. Am. Soc. C. E., vo

correction for velocity of approach being made by adding $1.5\frac{v^2}{2g}$ to the measured head to obtain H.[a]

Values of the ratio $\frac{C_1}{C}$ of the coefficient of discharge for a broad-crested weir, by Fteley and Stearns's experiments, to that for a thin-edged weir.

H	Width of crest, in inches.					
	3	4	6	8	10	12
0.0						
.1	0.7466	0.74798	0.7562	0.7589	0.7576	0.7576
.2	.8284	.7878	.7740	.7679	.7644	.7624
.3	.9172	.8521	.8003	.7809	.7727	.7685
.4	.9963	.9201	.8353	.8003	.7850	.7768
.5	.....	.9806	.8781	.8255	.8003	.7865
.6	.....	1.0080	.9230	.8567	.8199	.7989
.7	.....	.....	.9391	.8911	.8424	.8150
.8	.....	.....	.9997	.9245	.8695	.8339
.9	.....	.....	1.0317	.9558	.8983	.8552
1.0	.....	.....	.....	.9835	.9406	.8824
1.1	.....	.....	.....	1.0090	.9508	.9027
1.2	.....	.....	.....	1.0317	.9732	.9252
1.3	.....	.....	.....	1.0499	.9948	.9465
1.4	.....	.....	.....	.....	1.0148	.9657
1.5	.....	.....	.....	.....	1.0317	.9850

BAZIN'S FORMULA AND EXPERIMENTS ON BROAD-CRESTED WEIRS.

These included series of about 20 periods each for depths not exceeding 1.4 feet on weirs of 0.164, 0.328, 0.656, 1.315, 2.62, and 6.56 feet breadth of crest. The coefficient C_1 in the formula $Q = C_1 L H^{\frac{3}{2}}$, deduced from a recomputation of the experiments on weirs 2.46 feet high, using the Francis velocity of approach correction, is given on Pl. IV.

Other experiments were made for the four narrower weirs with heights 1.148 and 1.64 feet, to determine the comparative velocity of approach effect.

Bazin shows that if the nappe is free from the downstream face of the weir it may assume two forms: (1) It may adhere to the horizontal crest surface; (2) it may become detached at the upstream edge in such a manner as to flow over the crest without touching the downstream edge. In the second case the influence of the flat crest evidently disappears and the discharge is like that over a thin-edged weir. The nappe usually assumes this form when the depth D exceeds twice the breadth of crest B, but it may occur whenever the depth exceeds $\frac{1}{2}B$. Between these limits the nappe is in a state of instability; it tends to detach itself from the crest, and may do so under the

[a] Fteley and Stearns's formula for a thin-edged weir has been used to calculate Q in deriving these coefficients, the experiments having been made under conditions similar to those under which their formula was derived.

influence of any external disturbance, as, for example, the entrance of air or the passage of a floating object over the weir.

When the nappe adheres to the crest, the coefficient C_1 depends chiefly on the ratio D/B and may be represented by the formula

$$C_1 = C(0.70+0.185\ D/B) \quad . \quad . \quad . \quad . \quad . \quad (67)$$

in which C is the coefficient for a thin-edged weir.

When $D/B=1.50$ to 2, $C_1/C=0.98$ to 1.07 if the nappe adheres to crest, or $C_1/C=1.00$ if nappe is detached, and for $D/B>2$, $C_1/C=1.00$. Between the limits $D=1.5B$ and $D=2B$ the value which the coefficient C_1 will assume in a particular case is uncertain. Bazin considers that his formula gives accurate results for adhering nappes with breadth of crests up to 2 or 3 feet. For a crest 6.56 feet wide and $D=1.476$ feet he finds the result by formula (67) 93.4 per cent of that given directly by the experiment.

Values of the ratio C_1/C, for a broad-crested weir, with adhering nappe, by Bazin's formula.[a]

D/B	$C_1/C=0.700+0.185\ D/B$.									
	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.700	0.7018	0.7037	0.7056	0.7074	0.7092	0.7111	0.7130	0.7148	0.7166
.1	.7185	.7204	.7222	.7240	.7259	.7278	.7296	.7314	.7333	.7352
.2	.7370	.7388	.7407	.7426	.7444	.7462	.7481	.7500	.7518	.7536
.3	.7555	.7574	.7592	.7610	.7629	.7648	.7666	.7684	.7703	.7722
.4	.7740	.7758	.7777	.7796	.7814	.7832	.7851	.7870	.7888	.7906
.5	.7925	.7944	.7962	.7980	.7999	.8018	.8036	.8054	.8073	.8092
.6	.8110	.8128	.8147	.8166	.8184	.8202	.8221	.8240	.8258	.8276
.7	.8295	.8314	.8332	.8350	.8369	.8388	.8406	.8424	.8443	.8462
.8	.8480	.8498	.8517	.8536	.8554	.8572	.8591	.8610	.8628	.8646
.9	.8665	.8684	.8702	.8720	.8739	.8758	.8776	.8794	.8813	.8832
1.0	.8850	.8868	.8887	.8906	.8924	.8942	.8961	.8980	.8998	.9016
1.1	.9035	.9054	.9072	.9090	.9109	.9128	.9146	.9164	.9183	.9202
1.2	.9220	.9238	.9257	.9276	.9294	.9312	.9331	.9350	.9368	.9386
1.3	.9405	.9424	.9442	.9460	.9479	.9498	.9516	.9534	.9553	.9572
1.4	.9590	.9608	.9627	.9646	.9664	.9682	.9701	.9719	.9738	.9756
1.5	.9775	.9794	.9812	.9830	.9849	.9868	.9886	.9904	.9923	.9942

[a] If there is velocity of approach, the value of D/B, not H/B, should be used as an argument. The ratio C_1/C may be applied in a formula which includes the velocity of approach correction, either in the head H or in the coefficient.

Bazin's formula gives ratios which continually increase as D increases, B remaining constant, and which continually decrease as B increases, H remaining constant. It gives, however, a constant ratio for all widths or heads where the ratio H/B is unchanged.

Compared with their respective standard weir formulas, Mullins's formula gives for a broad-crested weir a continuously decreasing ratio of discharge as B increases from zero, H remaining constant, and a continuously increasing discharge as H increases from zero, B remaining constant; Fteley and Stearns's experiments give a discharge ratio which is less than unity, but which varies in an irregular manner, ...ding on the head and breadth of weir.

On referring to Pl. IV, in which the Bazin coefficients are given in a form comparable with the experiments of the United States Geological Survey, it will be noticed that, except for the lowest heads, the coefficient curves are simple linear functions of the head. The rate of increase of the coefficients as the head increases grows rapidly less as the breadth of the weir increases, indicating that for a very broad weir the coefficient would be sensibly constant throughout the range of stability of the nappe.

For the narrower weirs the coefficients tend to increase rapidly almost from the start toward the value for a thin-edged weir or detached nappe. For the weirs 2.62 and 6.56 feet breadth of crest the total variation in the coefficient for the range of heads covered by the experiments is comparatively small. The average coefficients are as follows:

Average Bazin coefficients, broad-crested weirs.

Bazin series No.	Crest width, in feet.	Range of head, in feet.		Average constant coefficient, G_1.
		From—	To—	
113	1.312	Lowest.	0.60	2.64
114	2.624	0.35	.85	2.59
			1.32	2.62
115	6 56	.55	Highest.	[a] 2.58

[a] Coefficient increases slowly throughout.

The average coefficients show a fair agreement with the constant coefficient for broad-crested weirs with stable nappe deduced from the experiments of the United States Geological Survey (page 120).

EXPERIMENTS OF THE UNITED STATES GEOLOGICAL SURVEY ON BROAD-CRESTED WEIRS.

The method of conducting these experiments and the detailed results are given on pages 95–107. The coefficient curves are presented on Pls. XXVIII to XXXII. It may be remarked here that the models were larger and the range of breadth of crest and depth of flow experimented upon was greater than in the earlier experiments described. In general, the laws of behavior of the nappe pointed out by Fteley and Stearns and Bazin were confirmed.

The following table presents a résumé of the results:

Résumé of United States Geological Survey experiments on broad-crested weirs.

Series.	Breadth of crest, in feet.	Nappe unstable for heads less than values below, in feet.	Nappe detached from crest at head, in feet.	Coefficient C_1 varies between the limits—				Coefficient constant.	
				Head, in feet.		Coefficient.			
				From—	To—	From—	To—	Above head, in feet.	C_1
40	0.479	0.3	0.8	0.3	0.8	2.64	3.32	0.8	3.32
47	.927	.3	1.8	.3	1.8	2.57	3.31	1.8	3.31
41	1.646	.7	2.8	.7	2.8	2.56	3.32	2.8	3.32
46	3.174	.5	.....	.5	1.3	2.70	2.64	1.3	Increases
45	5.875	.5	.....	.5	.9	2.72	2.64	.9	2.64
44	8.980	.5	.....	.5	2.0	2.73	2.62	2.0	2.62
42	12.239	.....	.....	.2	2.0	2.62 2.73	2.64	2.0	[a]2.64
43	16.302	.....	.....	.3	1.1	2.68	2.72 2.63	1.1	[b]2.63
43a	16.302	.4	.....	.4	1.0	2.72	2.64	1.0	2.64
Average.	.....	.....	.....	.....	.....	.....	.....	.....	2.634

[a] Coefficient shows tendency to increase slowly with head.

[b] Edges of planed and matched boards not flush. Crest smoothed in series 43a.

The deductions that follow have been based on a consideration of earlier experiments as well as those here given for the first time.

1. For depths below 0.3 to 0.5 foot the nappe is very unstable, owing probably to magnified effect of crest friction and to the varying aeration or adhesion of the nappe to the downstream weir face.

2. For heads from 0.5 foot to 1 or 2 feet for very broad weirs, or from 0.5 foot to the point of detachment for narrower weirs, the coefficient is somewhat variable and changes in an uncertain manner. For the broader weirs, the range of variation of C_1 between the depths indicated is narrow, from 2.73 to 2.62.

3. When the nappe becomes detached the coefficient remains nearly identical with that for a thin-edged weir. For the narrower weirs the coefficient increases rapidly within the range of tendency to detachment indicated by Bazin, i. e., for heads between D and $2D$.

4. On the broader weirs for depths exceeding 1 to 2 feet up to the limit of the experiments (about 5 feet), the experiments indicate a sensibly constant coefficient for all depths. Where there is any tendency to variation within the range indicated there is a gradual increase in C_1.

For weirs of 5 to 16 feet breadth the experiments show no conspicuous tendency for the coefficient C_1 to change with variation in either H or B, the range of value of C_1 being from 2.62 to 2.64.

The line of detachment of the nappe for a weir of 5 feet breadth would be 7.5 to 10 feet head or perhaps more, and a higher head for

broader crests. If this depth were ever reached it may be surmised that the coefficient C_1 would increase to about 3.33 at the point of detachment. It would also appear, as is in fact indicated in Bazin's formula, that the coefficient should very slowly increase with H and decrease as B increases, independent of the tendency to detachment of the nappe, and owing to the decreased relative effect of crest friction and contraction.

The United States Geological Survey experiments indicate that this effect is of relatively little significance for large heads and broad weirs, and hence a constant coefficient covering a wide range may be safely adopted.

The average coefficient, 2.64, which we have tentatively chosen for weirs exceeding 3 feet in breadth under heads exceeding 2 feet, may apparently be applied for considerably lower heads for weirs of 5 feet or more crest breadth with but small error.

TABLE OF DISCHARGE OVER BROAD-CRESTED WEIRS WITH STABLE NAPPE.

A table has been calculated, using $C_1=2.64$ and covering heads varying by 0.1 foot increment from zero to 10 feet (p. 177). It is considered applicable for weirs of 3 feet or more crest breadth when H/B lies between the general limits 0.25 to 1.5. The coefficient 2.64 gives a discharge 79.2 per cent of that for a thin-edged weir by the Francis formula. The relative discharge obtained by other formulas and experimenters is shown in the following table:

Comparison of broad-crested weir formulas and experiments giving percentage of discharge over a thin-edged weir.[a]

Formula or experiments.	1 foot width.			2.62 feet width.			6.56 feet width.			
	H/B=0.5	1.0	1.5	0.5	1.0	1.5	0.25	0.5	1.0	1.5
	H=0.5	1.0	1.5	1.31	2.62	3.93	1.64	3.28	6.56	9.84
Mullins[b]	96.7	97.5	98.0				93.2	95.5	97.5	98.2
Fteley and Stearns	78.6	88.2	98.5							
Bazin formula	79.2	88.5	97.8	79.2	88.5	97.8	74.6	79.2	88.5	97.8
U. S. Deep Waterways experiments				82.8	93.3	114.1	72.0	71.1	72.3	73.2
U. S. Geological Survey experiments	81.0	90.3	97.5	[c]79.5	[c]81.3	[c]86.7	79.2	[d]79.2	[d]79.2	[d]79.2

[a] No velocity of approach.
[b] East Indian engineers' formula, given in Mullins's Irrigation Manual, Madras Presidency.
[c] Weir 2.17 feet broad.
[d] Weir 5.88 feet broad.

Considering the low heads used, it may be noted that before Bazin's experiments only those of Blackwell included a weir breadth sufficient to eliminate the early tendency to detachment and permit the existence of the stable period for which a constant coefficient applies.

Blackwell's experiments on weirs 3 feet broad indicate a maximum coefficient C_1 of 2.65 to 2.77 for a head of about 0.5 foot, decreasing as the head increased.

The experiments of the United States Deep Waterways Board on models with 2.62 and 6.56 foot crest width are shown on Pl. XV. For the narrower weir the coefficient increased uniformly with the head. The nappe did not leave the crest, although the experiments were continued to the limit $H/B=2$, at which stage the coefficient exceeded that for a thin-edged weir. For the broader weir the coefficients are much less variable and the curves indicate that the coefficients approach a constant as the breadth of crest is increased.

It will be noted that considerable care must be exercised in determining the condition of the nappe for broad-crested weirs of inconsiderable width, while for those of greater breadth the wind may exert considerable influence on the nappe on the broad crest under lower heads. The constant coefficient 2.64 has been deduced from experiments on weirs with smooth, planed crests and sharp upstream crest angles. The effect of crest roughness on weir discharge is discussed on page 133.

EFFECT OF ROUNDING UPSTREAM CREST EDGE.

Experiments by Fteley and Stearns[a] indicate that the effect of rounding the upstream crest corner is to virtually lower the weir, by allowing the water to pass over with less vertical contraction. To determine the discharge over a thin-edged weir, with upstream crest corner rounded to a radius R, add to the measured head the quantity

$$K=0.70R \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (68)$$

The above formula was deduced by Fteley and Stearns from experiments on weirs with crest radii of one-fourth, one-half, and 1 inch. For heads not exceeding 0.17, 0.26, and 0.45 foot, respectively, the nappe adhered to the crest, and the formula does not apply.

The correction formula (68) is equivalent to increasing the discharge coefficient in the ratio

$$\left(\frac{H+0.7R}{H}\right)^{\frac{3}{2}}$$

or nearly in the ratio

$$\frac{H+R}{H}.$$

A second series of experiments was made with rounded upstream edges of similar radii applied to a crest 4 inches wide, giving the correction formula for this case,

$$K=0.41R \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (69)$$

[a] Experiments on the flow of water, etc.: Trans. Am. Soc. C. E., vol. 12, pp. 97-101.

e K is a correction to be added to the measured head before ing the formula for discharge over the broad-crested weir. This ula is applicable for depths of not less than 0.17 and 0.26 foot, ctively, on weirs with radii of one-fourth and one-half inch. y and Stearns's formulas show the effect to decrease with the lth of crest. It also decreases, when expressed as a percentage, the head. These formulas are probably applicable to weirs with er, though not to those with greatly larger, radii than those of the rimental weirs.

zin experimented upon two weirs, duplicated in the United States Waterways experiments, having crest widths of 2.624 and 6.56 respectively, with an upstream crest radius of 0.328 foot (Pl.

Broad-crested weirs with rounded upstream corner.

Head, in feet.	Coefficient C_1, Bazin's experiments.			
	Crest width, 2.62 feet.		Crest width, 6.56 feet.	
	With angle crest.	With rounded crest.	With angle crest.	With rounded crest.
0.25	2.52	2.85	2.40	2.58
.50	2.59	2.95	2.515	2.76
1.00	2.64	3.00	2.575	2.89
1.50	2.69	3.04	2.635	2.92
	Coefficient C_1, United States Deep Waterways experiments.			
1.50	2.67	2.92	2.39	2.81
2.00	2.75	3.00	2.41	2.81
3.00	2.93	3.17	2.44	2.81
4.00	3.11	3.34	2.47	2.81
5.00	3.30	3.51	2.50	2.81
6.00	Nappe free.	3.00	2.53	2.81

ited States Deep Waterways series 14 and 15, Pl. XV, show the of rounding the upstream crest corner, radius 0.33 foot, on a l of the Rexford flats, New York, dam. In this case, with a 22 feet broad with 6:1 slope on each face, the effect of rounding nes comparatively slight, the average increase being about 2 ent.

ited States Geological Survey experiments, series Nos. XXXV XXXVI, Pl. XXVI, show the effect of the addition of a 4-inch s (0.33 foot), quarter-round extension to the upstream face of the *l of an ogee-section* dam, having 4.5 feet crest width, 4.5:1 slope.

Effect of rounded upstream crest corner on an ogee dam.

Head, in feet.	Chambly model, series 35.	Same, with rounded upstream crest corner.	Difference per cent of Francis's coefficient.
0.50	3.18	3.23	+1.5
1.00	3.30	3.34	+1.2
2.00	3.42	3.51	+2.7
3.00	3.49	3.64	+4.5

EXPERIMENTS ON WEIRS WITH DOWNSTREAM SLOPE, OR APRON, OF VARYING INCLINATION.

Aside from the experiments of Blackwell on weirs with very slight inclination and a few series by other experimenters on weirs of irregular section involving aprons, the data on this subject are limited to those of Bazin's experiments.

Bazin selected a number of weir types, each having a constant top width, height, and upstream inclination and applied to each a number of different downstream slopes.[a]

TRIANGULAR WEIRS WITH VERTICAL UPSTREAM FACE AND SLOPING APRONS.

Such weirs are occasionally used, as where the apron slopes to the stream bed in log slides. A similar form in which the downstream slope terminates at a greater or less distance from the vertical upstream face is not uncommon, and to this form the Bazin experiments may probably be applied, provided the breadth of the sloping apron is considerable. The experiments are of special interest, however, as showing the effect of attaching a sloping apron to the downstream face of a thin-edged weir, and by inference affording an indication of the effect of a similar apron attached to any form of cross section. The results of Bazin's experiments recomputed on the basis of the Francis formula are shown on Pl. V.

Four series of experiments on weirs 2.46 feet high are included. For all these series the coefficient C tends to remain nearly constant for the range of heads covered, 0.2 foot to 1.5 feet, there being a slight increase in C with the lower heads only.

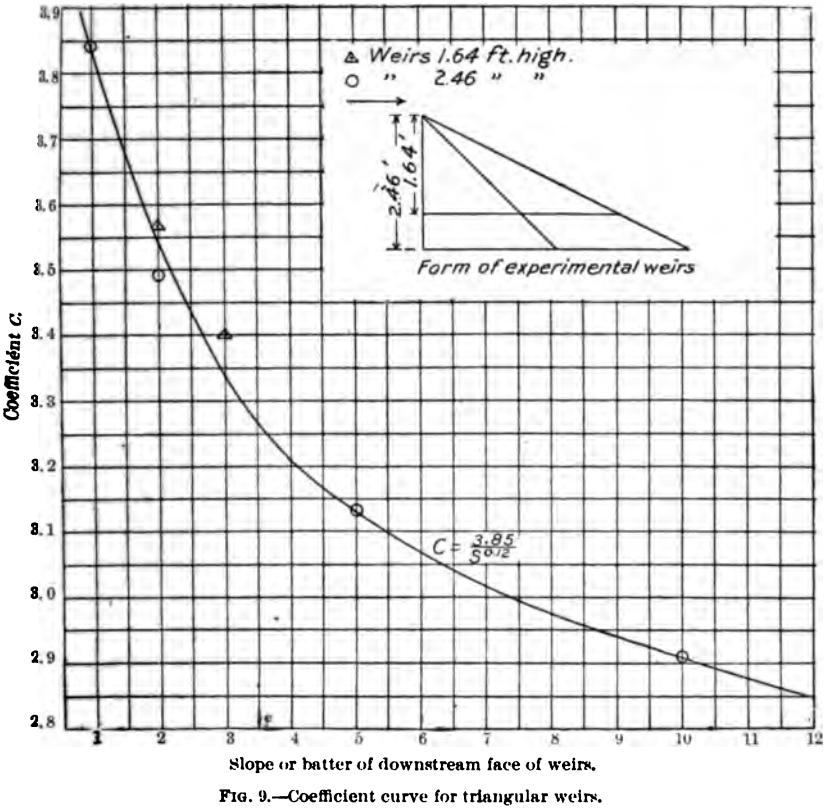
Two series on weirs 1.64 feet high are also given. In series 141, slope of apron 3:1, there is a general increase in coefficient with head below 0.9 foot. Series 138, for a weir 1.64 feet high, is duplicated on a weir 2.46 feet high, and the latter series is given preference in the general curve. The lower weirs indicate in both cases slightly higher coefficients, possibly owing to the incomplete elimination of the effect of excessive velocity of approach.

[a] *Bazin did not attempt to collate the results extensively. His general résumé has been translated by the writer, and may be found in Rept. U. S. Board of Engineers on Deep Waterways, pt. 2, 1900, pp. 646–658.*

The average constant coefficients for the several series are shown in the following table:

Mean coefficients, triangular weirs with varying apron slope.

Series.	Height.	Slope.	Range of head.		Range of C.		Average C.
			From—	To—	From—	To—	
136	2.46	1:1	0.3	1.40	3.84	3.88	3.85
137	2.46	2:1	.3	1.6	3.48	3.52	3.50
138	1.64	2:1	.7	1.5	3.56	3.58	3.57
145	1.64	3:1	.9	1.5	3.39	3.41	3.40
141	2.46	5:1	.6	1.5	3.08	3.14	3.13
142	2.46	10:1	.75	1.5	2.90	2.93	2.91



Slope or batter of downstream face of weirs.

FIG. 9.—Coefficient curve for triangular weirs.

The mean coefficients have also been plotted on fig. 9 and a general curve drawn. This curve becomes approximately a straight line when plotted on logarithmic cross-section paper. Its equation expressed in logarithmic form is

$$C = \frac{3.85}{S^{0.12}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (70)$$

where S is the batter or slope of apron.

If $S=6$, then, solving by logarithms,

$$\log 6 = 0.7781513$$
$$\log 6^{0.12} = 0.0933782$$
$$\log \frac{1}{6^{0.12}} = 9.9066218$$
$$\log 3.85 = 0.5854607$$
$$\log C = 0.4920825$$
$$C = 3.105$$

Fig. 9 gives C=3.07; the difference is 1 per cent.

The following conclusions deduced from the recomputed data conform in general with those of Bazin:

1. For steep apron slopes where the nappe tends to break free, the apron materially increases the discharge by permitting a partial vacuum to be formed underneath the nappe.

2. For flat apron slopes the conditions approach those for a horizontal crest.

3. For an apron slope of about 3:1, the discharge is nearly the same as for a thin-edged weir.

4. For slopes greater than 3:1 the apron diminishes the discharge the amount of diminution increasing as the slope becomes flatter.

TRIANGULAR WEIRS WITH UPSTREAM BATTER 1:1 AND VARYING SLOPE OF APRON.

Three series of experiments by Bazin are included (Pl. IX), all made from weirs 1.64 feet high. The results are comparable among themselves, but owing to the high velocity of approach their general applicability is less certain.

Series No. 161, downstream slope 1:1, shows a generally decreasing coefficient with an apparent tendency to become constant through a narrow range of heads, from 0.5 to 0.9 foot, with C=about 4.11.

Series No. 163 and 165, with apron slopes of 2:1 and 5:1, give coefficient lines, which may be fairly represented by the constants 3.82 and 3.47, respectively. These coefficients compare with those for vertical weirs with the same apron slopes as follows:

Comparative coefficients.

Batter of apron.	Vertical face. C	Face inclined 1:1. C	Difference, per cent, Francis's coefficient.
1:1	3.85	4.11	+ 7.8
2:1	3.53	3.82	+ 8.7
5:1	3.13	3.47	+10.2

EXPERIMENTS ON WEIRS OF TRAPEZOIDAL SECTION WITH UPSTREAM SLOPE OF ½:1, HORIZONTAL CREST, AND VARYING DOWNSTREAM SLOPES.

Five series of Bazin's experiments on weirs 2.46 feet high, with crest width of 0.66 foot, are shown on Pls. VI and VII. The curves indicate coefficients increasing with the head, the rate of increase being more rapid for the steeper apron slopes. There is a tendency to depression at about 0.4 foot head, representing, possibly, the point at which the nappe changes from adhering to depressed condition on the downstream face. The curves are all convex, and apparently approach a constant, which was not, however, reached within the limit of experiments, except, perhaps, for the flattest slope of 5:1. The coefficients increase in value as the steepness of the apron slope increases.

Three series of experiments on weirs similar to those above described, but with flat crests 1.317 feet wide, are shown on Pl. VIII. The coefficient curves are of uncertain form for heads below 0.6 foot. For greater heads they may be represented by inclined straight lines. The coefficients increase uniformly with the head, the initial values for 0.6 foot head being nearly the same for the several slopes, the increase being more rapid for the steeper downstream slopes.

It may be seen from the following table that increased width of the flat crest, as compared with that of the preceding weir, causes a decrease in the discharge.

Comparative coefficients at 1-foot head, weirs with flat crests and ½:1 upstream slope.

Slope of apron.	Crest width, in feet.	
	0.66	1.317
1:1	3.52	.....
2:1	3.38	2.985
3:1	3.265	.....
4:1	3.205	2.94
5:1	3.195	.....
6:1	.....	2.93

COMBINATION OF COEFFICIENTS FOR WEIRS WITH COMPOUND SLOPES.

Series 163 for an apron slope 2:1 represents a weir form which would be produced by placing, vertical face to vertical face, a weir with back slope 1:1 and a weir with apron slope 2:1. For the former, Bazin's experiments indicate 10 per cent excess discharge over that for a thin-edged weir, and for the latter (from Pl. V) $C=3.50$, equivalent to 5

per cent excess over a thin-edged weir. If the discharge over the 1:1 upstream slope was similarly increased by the addition of an apron, C would be $3.66 \times 1.05 = 3.84$. Pl. IX indicates $C = 3.82$.

The above method of determining the coefficient for weir of irregular cross section by combining the coefficients for two principal elements of which it is composed, as separate weirs, is restricted in its application and may lead to inconsistencies.

WEIRS WITH VARYING SLOPE OF UPSTREAM FACE.

Experiments were made by Bazin on thin-edged weirs inclined at various angles. Bazin found the ratio of the coefficient of discharge to that for a vertical thin-edged weir to be sensibly constant for all heads within the limits of his experiments, 0.0 to 1.5 feet. Bazin's results were expressed in the form of a modulus by which to multiply the coefficient for a vertical weir to obtain that for an inclined weir. Assuming the Francis coefficient 3.33 to apply to a vertical weir, the coefficients for weirs of various inclinations would be as follows:

Coefficients for inclined weirs, Bazin's experiments.

		Bazin's modulus.	c
Upstream inclination of the weir	1 horizontal to 1 vertical	0.93	3.097
	2 horizontal to 3 vertical	.94	3.130
	1 horizontal to 3 vertical	.96	3.197
Vertical weir		1.00	3.330
Downstream inclination of the weir	1 horizontal to 3 vertical	1.04	3.463
	2 horizontal to 3 vertical	1.07	3.563
	1 horizontal to 1 vertical	1.10	3.663
	2 horizontal to 1 vertical	1.12	3.996
	4 horizontal to 1 vertical	1.09	3.630

On Pl. XVI are shown the results of United States Deep Waterways experiments on weirs 4.9 feet high, having horizontal crests 0.67 foot broad, and with various inclinations of the upstream slope. The experiments cover heads from 1.75 to 5.2 feet, but only 3 or 4 points are given on each coefficient curve. The results indicate in a general way, however, nearly constant coefficients for each inclination of the upstream face. The values of the coefficients are considerably smaller than those obtained by Bazin, whose experiments were on weirs 2.46 feet high with sharp crests.

Pls. X, XI, and XII show the results of experiments of Bazin on weirs of irregular section, with various upstream slopes. Pl. X includes 5 series of experiments on weirs 1.64 feet high, with sharp

crest angles, and 2 : 1 downstream slopes. The coefficient curves show a depression period at from 0.3 to 0.7 foot head, beyond which the coefficients may be fairly represented by constants up to 1.5 foot head (the limit of the experiment). A general curve showing the constant coefficient in terms of a downstream slope or batter has been added. This indicates a maximum coefficient of discharge for an upstream slope of about 2.6 : 1. Bazin found, for thin-edged weirs, with inclined downstream slopes, a maximum coefficient for an inclination of 30°, or $1\frac{3}{4}$: 1.

Pls. XI and XII show coefficient curves for weirs having the same upstream slopes as in Pl. X, but 2.46 feet high, and with flat crests 0.67 foot wide. The coefficient curves are convex outward, indicating that they may approach constant values at some point beyond the limits of the experiments. The marked difference in character of these coefficient curves, as compared with those in the preceding group, is notable. For weirs with flat crests 0.67 foot wide the coefficients for a given head uniformly increase as the slope becomes flatter up to a batter of about $1\frac{3}{4}$: 1. They are also greater for all heads within the limit of the experiments than the coefficients for weirs with sharp crest angles. The comparative values are indicated in the following table:

Comparative coefficients, weirs with varying upstream slope.

Upstream slope.	Pl. X, sharp crest, 2:1 downstream slope; average constant coefficient.	Pls. XI and XII, 0.67 feet crest width, 2:1 downstream slope. Head, in feet.		
		0.5	1.0	1.5
	C	C	C	C
Vert.	3.58	2.78	3.26	3.51
$\frac{1}{4}$: 1	3.68	2.87	3.34	3.56
$\frac{1}{2}$: 1	3.72	2.92	3.38	3.62
1 : 1	3.83	3.03	3.42	3.65
2 : 1	3.87	3.13	3.43	3.61

It will be seen that the addition of the flat crest has an effect in this case similar to that observed in Pls. VI and VIII, showing the results of experiments by Bazin on weirs with various downstream slopes.

United States Deep Waterways series No. 7, Pl. XVII, may be compared with Bazin's series No. 178, shown on Pl. XI. The former gives a coefficient of 3.55 for a head of 2 feet on a weir 4.895 feet high, the coefficient slowly increasing with the head. The latter gives a coefficient of 3.6 for a head of 1.5 feet, decreasing rapidly as the head decreases.

United States Geological Survey series No. XXXIX, Pl. XXVIII, and United States Deep Waterways series No. 18, Pl. XVIII, represent weirs with vertical downstream faces and inclined crests. The upstream slope does not, however, extend back to the bottom of the channel of approach, but is cut off abruptly by a vertical upstream face. The average coefficients deduced from these series have been plotted on a general curve on Pl. XVI, the coefficients agreeing closely with those of the United States Deep Waterways experiments on weirs of similar upstream slope, extending to the channel bottom. United States Geological Survey series No. XXX represents the Dolgeville dam, with rounded crest removed, leaving a trapezoid with crest 6 feet broad and 1 foot lower at upstream than at downstream edge. The coefficient is not constant, but apparently approaches a constant value of about 3.25 for heads exceeding 3 feet. United States Deep Waterways series No. 18 represents a model of the spillway of the Indian Lake dam, having a crest 7 feet wide, 1.5 feet lower at upstream than at downstream edge, which gives an average constant coefficient of 3.42.

It is suggested that if the upstream slope of an inclined weir is continued back 6 feet or more and terminates in a vertical upstream face, the discharge coefficient will not differ materially from that for an upstream slope extending to the channel bottom.

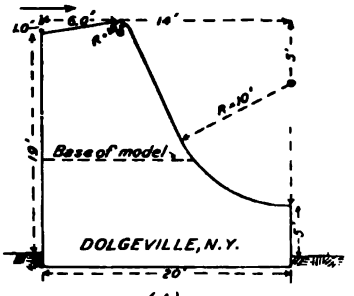
DAMS OF OGEE CROSS SECTION, PLATTSBURG-CHAMBLY TYPE.

The United States Geological Survey experiments on dams of this type are shown on Pls. XXIII to XXVII. Cross sections of the various dams, with lines indicating the comparative size of the models used in the United States Geological Survey experiments, are shown on Pl. XXXIV. Cross sections of other ogee dams used as weirs are shown on Pl. XXXV.

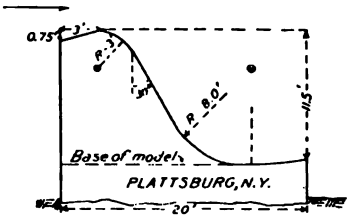
This class includes dams with downstream crest radius sufficiently large to retain the nappe always in contact, yet not so large as to simulate a broad flat crest. We thus exclude the Dolgeville section on the one hand, in which the nappe as observed in the existing dam partially or completely breaks free near the crest for other than very low stages, and on the other hand, the Austin dam, with a crest radius of 20 feet, which appears, from the meager data available, to lie outside this class.

We have arranged the available data in order, advancing with decreased breadth and increased inclination of sloping upstream face.

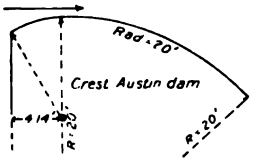
The coefficients for various depths are as follows:



(A)



(B)



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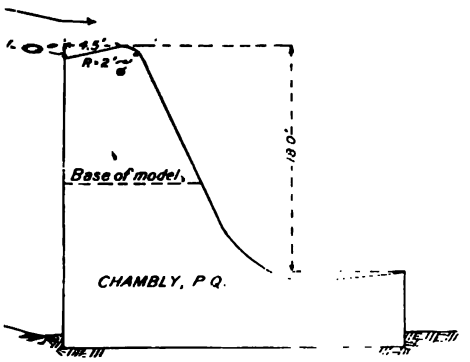

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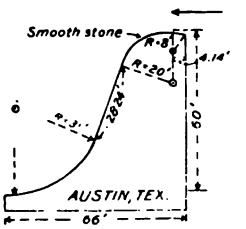
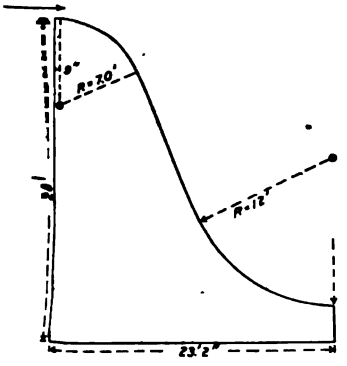
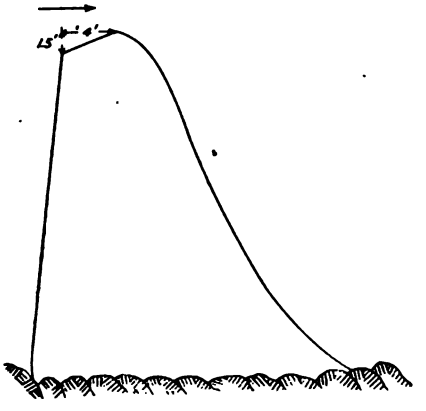


(D)

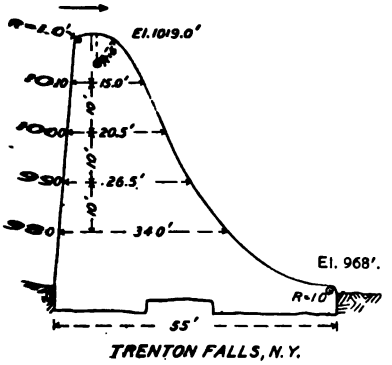
COMPARATIVE SIZE OF MODELS AND SECTIONS OF OGEE DAMS.



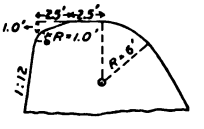
BEAVER RIVER, N.Y.



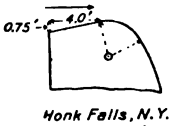
HANNAWA FALLS, N.Y.



TRENTON FALLS, N.Y.



Crest, Trenton Falls



Honk Falls, N.Y.
Crest section

CROSS SECTIONS OF OGEE DAMS.

Comparative coefficients, dams of ogee cross section.

Dam	Chambly.	Plattsburg.	Modified Plattsburg.					
Approx. constant coefficient	3.435	3.48	3.48	3.48	3.70	3.70	3.70	.....
Breadth of slope, in feet	4.5	3	3	3	3	3	3	3
Batter of slope	4¼:1	4:1	4:1	4:1	2:1	2:1	2:1	1.04:1
Crest radius, in feet	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Experiment	.....	U.S.G.S.	U.S.G.S.	Mean of	U.S.G.S.	U.S.G.S.	Mean of	U.S.G.S.
Series	.....	[a] 30	[b] 31	30-31	[b] 32	[a] 33	32-33	34
Head 0.5 foot	.....	3.22	.....	.....	3.29	3.22	3.255	.....
1.0 foot	3.30	3.43	3.29	3.36	3.37	3.44	3.405	3.46
2.0 feet	3.42	3.42	3.35	3.385	3.51	3.67	3.59	3.75
3.0 feet	3.49	3.47	3.43	3.45	3.57	3.72	3.645	3.87
4.0 feet	3.53	3.52	3.54	3.53	3.67	3.74	3.705	3.88
5.0 feet	.....	.....	3.62	.....	3.73	.....	.....	.....
6.0 feet	.....	.....	.....	.....	.....	.....	.....	.....

[a] 15.969 feet crest length, without end contraction.
[b] 7.979 feet crest length, one end contraction.

It appears that the rounded crest changes the character of the law of coefficient from a value tending toward a constant for each back slope to a slowly increasing function of the head. Compared with the constant coefficients for weirs with similar upstream slopes extending back to canal bottom, and with vertical faces, we find that the constant values deduced for these cases correspond with the values of the varying coefficients for ogee sections at a medium head of 2 to 4 feet.

By plotting the data for weirs of ogee section on logarithmic cross-section paper the following convenient approximate formula has been deduced, applicable for weirs with 2 or 3 feet crest radius and upstream slopes 3 to 4.5 feet broad. S indicates the batter ratio of the slope, $\frac{\text{horizontal run}}{\text{vertical rise}}$.

$$C=[3.62-0.16\,(S-1)]\,H^{\frac{1}{10}} \quad . \quad . \quad . \quad . \quad . \quad (71)$$

If $S=2:1$ $\quad H=4.0$ $\quad C=3.46\times 4^{\frac{1}{10}}$.

$$\log 4^{\frac{1}{10}}=0.030103 \qquad C=3.46\times 1.0716=3.70.$$

The experiments give $C=3.74$.

EXPERIMENTS ON DISCHARGE OVER ACTUAL DAMS.

On Pl. XXXVII are shown the results of a number of experiments made by measuring the discharge over existing dams by means of floats or current meters. Aside from those for the Austin, Tex., dam, the data have been collected by Mr. George T. Nelles.[a]

[a] Discussion of paper by G. W. Rafter on the flow of water over dams: Trans. Am. Soc. C. E., vol. 44, pp. 359-362.

BLACKSTONE RIVER AT ALBION, MASS.

This is a timber dam 217 feet long, with horizontal crest 1 foot wide, vertical downstream face, and upstream slope covered with riprap. Discharge was measured by current meter 500 feet below dam, and the depth was measured by hook gage 20 feet upstream from crest. Coefficients have not been corrected to eliminate velocity of approach. They illustrate the uncertainty of discharge for broad-crested weirs of small width under low heads.

MUSKINGUM RIVER, OHIO.

Discharge was measured by rod floats in a cross section 500 feet above the dams, which are constructed of timber cribs filled with stone. Data by Maj. W. H. Bixby, U. S. Army.

Discharge data for Muskingum River dams.

Number of dam.	Length on crest, in feet.	Mean height, in feet.	Area of discharge section, in square feet.	Discharge, in cubic feet per second.	Mean velocity, in feet per second.	Fall over dam, in feet.	Observed depth on crest, in feet.	Coefficient C.
3	848	12.6	7,765	18,118	2.333	8.00	2.86	4.419
4	535	15.9	8,360	25,559	3.045	6.70	4.66	4.723
7	472	14.2	8,230	21,015	2.553	7.00	4.40	4.812
8	515	16.0	7,330	22,310	3.044	5.16	5.90	3.015

The depth on crest has not been corrected to eliminate velocity of approach.

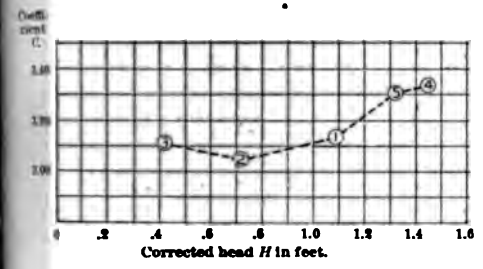
OTTAWA RIVER DAM, CANADA.

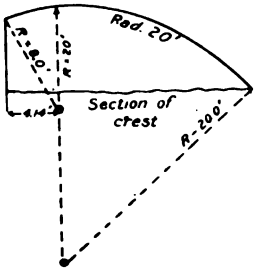
Data by T. C. Clark, C. E. Dam 30 feet high, with upstream and downstream faces planked and sloping 3:1, forming sharp crest angle at junction.

Discharge data for Ottawa River dam.

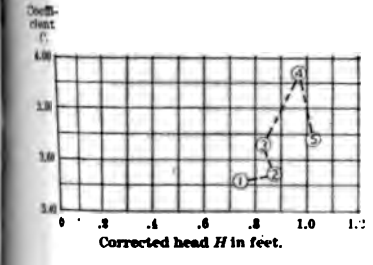
Length of dam, in feet.	Depth on crest, in feet.	Discharge, in cubic feet per second.	Discharge coefficient C.
1,600	2.5	26,000	4.106
1,760	10.0	190,000	3.408

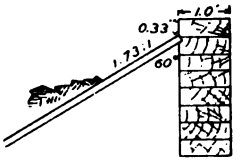
These data are notable as giving the only authentic value of discharge over a dam under so great a head as 10 feet. The high coefficient found for a head of 2.5 feet renders the results somewhat doubtful.



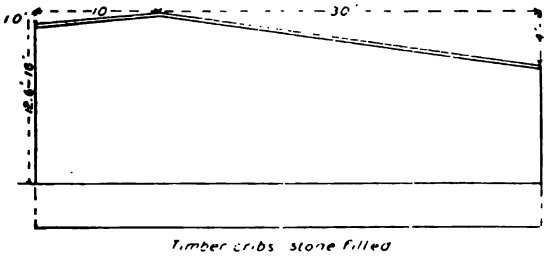


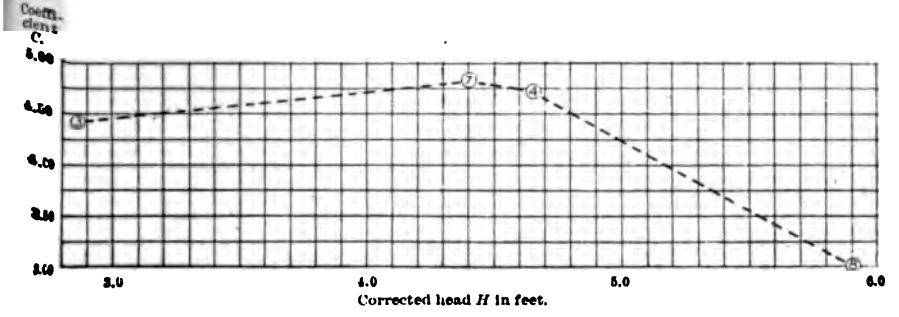
TAYLOR-HOWARD EXPERIMENTS ON DAM AT AUSTIN, TEX





EXPERIMENTS OF DWIGHT PORTER, BLACKSTONE RIVER, ALBION, MASS.





MUSKINGUM RIVER DAM. DATA BY MAJ. W. H. BIXBY, U. S. A.

EXPERIMENTS TO DETERMINE COEFFICIENT C FROM ACTUAL DAMS.

AUSTIN, TEX., DAM.[a]

A series of current-meter measurements of the discharge over this dam were made in January and March, 1900. Several observations at each depth have been combined. The resulting mean coefficients are given in the following table:

Discharge coefficients for the Austin, Tex., dam.

Date.	Number.	H	H=depth at crest of dam.	Range of variation of C.		Number of determinations.	Average value of C.
				From—	To—		
1900.							
Jan. 15	1	1.09	0.838	3.09	3.14	4	3.132
Jan. 18	2	.72	.625	3.00	3.11	11	3.053
Jan. 26	3	.42	.33	3.06	3.13	4	3.112
Mar. 28	4	1.44	1.04	3.32	3.36	3	3.333
Mar. 28	5	1.32	.96	3.26	3.33	5	3.302
Average	.....	.....	.....	.....	.....	.....	3.186

ROUGHNESS OF CREST.

The models used in weir experiments have usually been constructed of planed and matched timber. In actual dams a wide variety of conditions exist, including, in the order of roughness, sheet-steel crests, boards smoothed by wear and rendered slippery by water soaking and fungus growths, unplaned boards, dressed masonry, formed concrete, rubble and undressed ashlar, with earth, cobble, or broken-stone approaches. For the determination of the extent, if any, to which the coefficient applying for a smooth-crested dam must be modified to apply to any of these conditions, the following data are available.

UNITED STATES DEEP WATERWAYS, SERIES 7 AND 8 (PL. XVII).

Model dams, 4.9 feet high, 2:1 slope on both faces. The mean coefficients are about 1 per cent greater for crest of planed boards than for crest covered with one-fourth-inch mesh wire cloth.

[a] Taylor, T. U., the Austin dam: Water-Sup. and Irr. Paper No. 40, U. S. Geol. Survey, 1900, p. 33.

CROTON DAM, ROUND-CREST SECTION, MODEL A (PL. XIX).

Crest rounded, radius 10 feet. Upstream slope about 6:1.

Comparative coefficients with varying roughness, Croton round crest.

Series.....	1	1a	2	3
Head, in feet.	Smooth-pine crest.	Unplaned-plank crest and slope.[a]	Broken-stone slope, unplaned crest.	Broken-stone slope, wire cloth on crest.
0.25	3.34	2.84	3.18	3.16
.50	3.24	2.91	3.18	3.09
1.00	3.21	3.04	3.19	3.15
1.50	3.21	3.12	3.20	3.15
2.00	3.21	3.15	3.21	3.15
2.50	3.21	3.15	3.22	3.15
3.00	3.21	.....	3.22	3.15

[a] This series appears doubtful.—R. E. H.

CROTON DAM, ANGULAR SECTION, MODEL B (PL. XX).

Apron slope 1.25:1, upstream slope 6.24:1 for 13 feet, then rough and slope about 4:1 to bottom.

Comparative coefficients, varying roughness, Croton angular crest.

Series. / Head.	Unplaned plank..	Unplaned plank, rough-stone approach.	Rough-stone approach, wire cloth on crest.
0.25	3.61	.....	3.56
.50	3.63	3.66	3.57
1.00	3.67	3.66	3.58
1.50	3.68	3.66	3.60
2.00	3.70	3.66	3.61
2.50	3.70	3.66	3.62

The data given above are somewhat discordant, but indicate that in general the decrease in discharge resulting from the roughness of the various materials forming the crests and approaches of dams will not exceed from 1 to 2 per cent for low heads, and usually decreases as the depth of overflow increases.

FALLS.

Bellasis[a] presents the following analysis for a fall in which there is neither a raised weir nor a lateral reduction in section. If v is the mean velocity at CD, near to AB, then v is both the velocity of approach and the velocity in the weir formula

$$v=\frac{2}{3}\,c\sqrt{2g\left(D+\alpha\frac{v^2}{2g}\right)},$$

FIG. 10.—Fall.

where c is a coefficient of velocity.

$$v^2=\frac{4}{9}\,c^2\,2gD+\frac{4}{9}\,\alpha c^2v^2$$

$$\left(1-\frac{4}{9}\,\alpha c^2\right)v^2=\frac{4}{9}\,c^2\,2gD$$

$$v=\frac{\frac{2}{3}\,c\sqrt{2gD}}{\sqrt{1-\frac{4}{9}\,\alpha c^2}}$$

Making $\alpha=1.00$ and $c=0.79$.

$$v=\frac{3.424\,\sqrt{D}}{\sqrt{1-0.277}}=4.74\,\sqrt{D} \quad . \quad . \quad . \quad . \quad . \quad . \quad (72)$$

$$Q=vDL=4.74\,LD^{\frac{3}{2}}$$

The depth D is to be measured so near AB that the water shall have acquired its velocity of efflux. The depth will, of course, be affected by the surface curve, the upstream extension of which will be longer according as the slope of the leading channel is flatter, being very great for a horizontal channel. The formula needs experimental verification, but affords a convenient basis of approximation of the flow through troughs and sluices and over aprons and falls.

Experimental data for c are needed.

[a] Hydraulics, p. 99.

WEIR CURVED IN PLAN.

Milldams of both wood and masonry are often constructed to bow upstream, sometimes to secure the added strength of arched form, or to secure additional spillway length, or to follow the crest of a favorable rock ledge, or to throw the ice-bearing current away from intake gates. The dam may follow the arc of a circle, or, as is common with timber dams, there may be an abrupt angle in the plan of the dam. Fig. 11 shows a graphical comparison of curved and angle dams with a straight dam across the same channel, the former being each 13.5 per cent longer than the straight crested dam.

If such an arched spillway opens out of a broad, deep pond, the discharge over it would be greater than for a straight overfall very nearly in proportion to the excess in length of the arc as compared with the length of its chord.

When the stream is confined in a restricted channel, the increased velocity of approach above the longer spillway will become a factor. Thus if two dams—one straight, the other arched—were placed in the same straight, uniform channel, and the depth on crest measured at the same distance upstream from each, then, with the same measured head on both, the velocity of approach to the arched dam would be

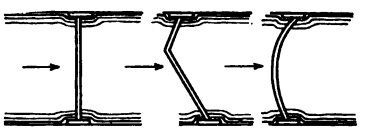


FIG. 11.—Weir curved or angular in plan.

greater nearly in the same proportion that its length of crest and discharge are greater than for the straight crest. Properly corrected for velocity of approach, the arched dam will give a correct measurement of the discharge, the length of the arc being used as the crest length. When the length of the arc greatly exceeds the channel width, the velocity of approach may become excessive, introducing uncertainty as to the proper correction coefficient, difficulty in measuring the head, and an uplifting of the central swifter-flowing portion of the stream surface.

The circular overflow lip of a vertical artesian-well casing is sometimes used to approximate the flow, the measured depth of water above the lip of the pipe, together with its circumference, being used in the weir formula.[a]

[a] Experiments showing the discharge over a circular weir to be proportional to the length of the arc were made by Simpson at Chew Magna, Somersetshire, England, 1850, not recorded in detail.

SUBMERGED WEIRS.

THEORETICAL FORMULA.

In a "submerged," "drowned," "incomplete," or "partial" weir the water on the downstream side stands above the crest level.

The submerged weir is not extensively used as a device for stream gaging. A knowledge of the relations of head, rise, and discharge of such weirs is, however, of great importance in works of river improvement, canals, etc., and the leading formulas are here presented.

It may be added that for situations where head can not be sacrificed, precluding the use of an ordinary weir, and where the velocity is not a continuous function of the depth, as in race ways, making a channel-rating curve inapplicable, the use of submerged weirs to measure or control the discharge merits consideration. Their use for such purposes as the equable division and distribution of water in power canals has hitherto been very restricted, owing to the lack of experimental coefficients.

Let H=Head on upstream side, corrected for velocity of approach.

D=Measured head, upstream side of weir.

d=Measured head, downstream side of weir, or the depth of drowning, taken below the ressault.

Z=Difference of elevation, upstream and downstream sides $=H-d$.

P=Height of weir above channel bottom.

L=Length of weir crest, feet.

v=Mean velocity of approach.

Δ=Head on a thin-edged weir that would give the same discharge.

M' and C' coefficients of discharge for a submerged weir.

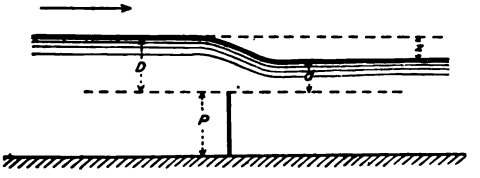


FIG. 12.—Submerged weir.

The theoretical formula of Dubuat for discharge is obtained by regarding the overflow as composed of two portions, one through the upper part $D-d$, treated as free discharge, the other through the lower part d, treated as flow through a submerged orifice.

Combining the two discharges,

$$Q=Q_1+Q_2=\frac{2}{3}\sqrt{2g}\,L(D-d)^{\frac{3}{2}}+Ld\sqrt{2g(D-d)}$$

By reducing, including a coefficient, and using the head H corrected for velocity of approach, we have the general formula for a submerged weir.

$$Q=\frac{2}{3}M'L\sqrt{2gZ}\left(H+\frac{d}{2}\right)=C'L\left(H+\frac{d}{2}\right)\sqrt{Z} \quad . \quad . \quad . \quad (73)$$

The head due to the velocity of retreat should in strictness be subtracted from the depth of submergence d. This is not commonly done, however, in the experiments, where the usual method of producing the submergence is by damming and retarding the water below. In practice, if the velocity of retreat is large, the correction should be made.

The theory of formula (73) makes $C'=1.5$ times the value of the coefficient C in the free portion of the discharge.[a] This value is adopted by Dubuat and Weisbach.

D'Aubuisson gives $C'=1.43\,C$.

Francis's early experiments make $C'=1.38\,C$.

From gage records of large rock-filled crib dams on Kentucky River, having planked upstream slope 3:1 and vertical steps below crest—height of dams about 20 feet, heads 4 to 7.5 feet, mean 5.3 feet—Nelles found results as follows:

Dam No. 3, water falling slowly 4 days,	$C'=1.5\,C$.
Dam No. 2, water falling slowly 3 days,	$C'=1.53\,C$.
Dam No. 1, water rising and falling slowly 5 days,	$C'=1.46\,C$.

FTELEY AND STEARNS SUBMERGED-WEIR FORMULA.[b]

Fteley and Stearns use the base formula

$$Q=CL\left(H+\frac{d}{2}\right)\sqrt{Z} \quad . \quad . \quad . \quad . \quad . \quad . \quad (74)$$

Coefficients for the above formula were derived from experiments on thin-edged weirs, by Fteley and Stearns and by J. B. Francis, and give correct results for weirs for which the free discharge would be correctly calculated by the Francis formula.

The head on upstream side varied from 0.3251 to 0.9704 foot, and $\frac{d}{H}$ varied from -0.063 to 0.081 with air under nappe, and from 0.077 to 0.975 with no air under nappe, and in applying the formula the same conditions should be complied with. The authors comment that where sufficient head can not be obtained for a weir of the usual free-discharge type, a submerged weir may be used, provided that the head does not vary greatly.

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[a] See valuable discussion of submerged weirs by Geo. T. Nelles in Trans. Am. Soc. C. E., vol. 44, pp. 359–383.

[b] Fteley and Stearns, Experiments on the flow of water, etc.: Trans. Am. Soc. C. E., vol. 12, pp. 101–108.

From a large-scale curve Fteley and Stearns derive the following table of coefficient C, for formula (74):

Fteley and Stearns's coefficients for submerged weirs.

$\frac{d}{H}$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	.....	3.330	3.331	3.335	3.343	3.360	3.368	3.371	3.372	3.370
.1	3.365	3.359	3.352	3.343	3.335	3.327	3.318	3.310	3.302	3.294
.2	3.286	3.278	3.271	3.264	3.256	3.249	3.241	3.234	3.227	3.220
.3	3.214	3.207	3.201	3.194	3.188	3.182	3.176	3.170	3.165	3.159
.4	3.155	3.150	3.145	3.140	3.135	3.131	3.127	3.123	3.119	3.116
.5	3.113	3.110	3.107	3.104	3.102	3.100	3.098	3.096	3.095	3.093
.6	3.092	3.091	3.090	3.090	3.089	3.089	3.089	3.090	3.090	3.091
.7	3.092	3.093	3.095	3.097	3.099	3.102	3.105	3.109	3.113	3.117
.8	3.122	3.127	3.131	3.137	3.143	3.150	3.156	3.164	3.172	3.181
.9	3.190	3.200	3.209	3.221	3.233	3.247	3.262	3.280	3.300	3.325

Where $\frac{d}{H}$ is less than 0.15 Q is not sensibly affected by submergence.

Where $\frac{d}{H}$ is from 0.5 to 0.8 C may be taken at 3.10.

Correction for velocity of approach was made by the formula $H=D+\frac{v^2}{2g}$. No correction was made for velocity of retreat.

The formula is probably applicable to larger dams and greater depths by selecting proper values of C, $\frac{d}{H}$ being a relative quantity.

A number of empirical formulæ for submerged-weir discharge are also used.

CLEMENS HERSCHEL'S FORMULA.[a]

Herschel's formula, based on experiments of J. B. Francis, 1848, Fteley and Stearns, 1877, and J. B. Francis, 1883, is

$$Q=3.33\ L(NH)^{\frac{3}{2}}=3.33\ L\triangle^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad (75)$$

In this formula the measured head[b] is reduced to an equivalent head that would give the same discharge over a free overflow. The value of the coefficient $N=\frac{\triangle}{H}$ depends on the proportional submergence $\frac{d}{H}$.

[a] Herschel, Clemen, The problem of the submerged weir: Trans. Am. Soc. C. E., vol. 14, May, 1885, pp. 190-196.

[b] Corrected for velocity of approach by method for Francis's formula before applying in above formula.

The values of this ratio, together with their probable error, are given below.

Coefficient N, Herschel's submerged-weir formula.[a]

$\frac{d}{D}$	0.0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	1.000	1.004	1.006	1.006	1.007	1.007	1.007	1.006	1.006	1.005
.1	1.005	1.003	1.002	1.000	.998	.996	.994	.992	.989	.987
.2	.985	.982	.980	.977	.975	.972	.970	.967	.964	.961
.3	.959	.956	.953	.950	.947	.944	.941	.938	.935	.932
.4	.929	.926	.922	.919	.915	.912	.908	.904	.900	.896
.5	.892	.888	.884	.880	.875	.871	.866	.861	.856	.851
.6	.846	.841	.836	.830	.824	.818	.813	.806	.800	.794
.7	.787	.780	.773	.766	.758	.750	.742	.732	.723	.714
.8	.703	.692	.681	.669	.656	.644	.631	.618	.604	.590
.9	.574	.557	.539	.520	.498	.471	.441	.402	.352	.275

[a] Values for $\frac{d}{D}$ exceeding 0.80 less accurately determined.

$\frac{d}{D}$ = 0.02 to 0.14, variation of $N = \pm 0.005$ to 0.007.
= 0.15 to 0.22, variation of $N = \pm 0.008$ to 0.010.
= 0.24 to 0,32, variation of $N = \pm 0.012$ to 0.014.
= 0.33 to 0.41, variation of $N = \pm 0.015$ to 0.017.
= 0.42 to 0.59, variation of $N = \pm 0.018$.
= 0.60 to 0.65, variation of $N = \pm 0.017$ to 0.015.
= 0.66 to .071, variation of $N = \pm 0.014$ to 0.012.
= 0.72 to .084, variation of $N = \pm 0.011$ to 0.009.

This table indicates that for depths of submergence not exceeding 20 per cent, the head will not ordinarily be increased more than 2 per cent.

The discharge over a submerged weir, according to Herschel's formula, bears the ratio $N^{\frac{3}{2}}$ to that over an unsubmerged weir under the same head.

THE CHANOINE AND MARY FORMULA.

$$Q = M' L H \sqrt{2gZ} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (76)$$

This expression has a form similar to that for the ordinary formula for submerged orifices. It is applicable only under conditions identical with those for which M' has been determined.[a]

[a] Van Nostrand's Eng. Mag., vol. 34, p. 176.

R. H. RHIND'S FORMULA.[a]

$$Q=M'L\sqrt{2g}\left[d\sqrt{Z+0.01v^2}+\frac{2}{3}Z\sqrt{Z+0.035v^2}\right] \quad . \quad . \quad (77)$$

This may be reduced to the theoretical formula (73) by omitting the correction for velocity of approach.

BAZIN'S FORMULAS.[b]

By duplicating, with various depths of submergence, his experiments on thin-edged weirs Bazin deduced the following expressions for the coefficients for submerged weirs to be applied in the discharge formula

$$Q=m'\,LD\,\sqrt{2gD}.$$

Let P represent, as heretofore, the height of weir crest above channel bottom, the coefficient m being that which would apply to the same weir with free discharge.

(1) Accurate formula with small values of d:

$$m'=m\left[1.06+0.16\left(\frac{d}{P}-0.05\right)\frac{P}{D}\right] \quad . \quad . \quad . \quad . \quad . \quad . \quad (78)$$

(2) Accurate formula with large values of d:

$$m'=m\left[\left(1.08+0.18\,\frac{d}{P}\right)\sqrt[3]{\frac{D-d}{D}}\right] \quad . \quad . \quad . \quad . \quad . \quad (79)$$

(3) Approximate formula for all cases:

$$m'=m\left(1.05+0.21\,\frac{D}{P}\right)\sqrt[3]{\frac{D-d}{D}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (80)$$

The above formulas are for weirs without end contractions.

The coefficient m contains the correction for velocity of approach of the free-discharge weir, and m' contains the necessary factor (if any) for the resulting modification of the velocity of approach effect, when the weir becomes drowned. They are only strictly accurate, therefore, when m' is substituted for m in Bazin's formula.

In Bazin's formulas the height P of the weir enters as a controlling factor in (1), and is present less prominently in (2) and (3).

The modification by drowning is made to depend on $\frac{d}{P}$ in (2), and on this ratio and that of the cube root of $\frac{D-d}{D}$ jointly in formula (3). It is often difficult to determine P or to apply these formulas to a weir fed by a large pond and having end contractions.

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[a] Proc. Inst. Civil Engineers, 1886.

[b] Bazin, H., Expériences nouvelles sur l'écoulement en déversoir, 6me art., Ann. Ponts et Chaussées, Mémoires et Documents, 1898.

Assume $P=\infty$

Then (2) becomes

$$m'=m\times 1.08\sqrt[3]{\frac{D-d}{D}}=m\times 1.08\sqrt[3]{\frac{Z}{H}} \quad . \quad . \quad . \quad . \quad (81)$$

and differs from (3) when similarly reduced only in the substitution of 1.05 for 1.08 as a coefficient.

Ex. $D=4'$ $d=2'$ $P=\infty$

If $m=0.425$

$$m'=0.425\times 1.08\sqrt[3]{\frac{2}{4}}=0.364,$$

the discharge being 89.4 per cent of that over an unsubmerged weir under the same head.

Comparison of submerged-weir formulas.[a]

d, feet	.25	.50	.75	.25	.50	.75
H, feet	2.0	2.0	2.0	1.0	1.0	1.0
d/H	¼	¼	¼	½	½	½
	Percentage of unsubmerged-weir discharge.					
Fteley-Stearns	99.91	95.06	89.29	95.01	82.61	64.02
Herschel	100.15	95.83	90.56	95.83	84.24	64.95
Bazin (3)	100.43	95.40	89.78	95.40	83.34	66.15

[a] Weir assumed to be very high so that there is no velocity of approach or of retreat. The coefficient of discharge for a thin-edged weir with free discharge has been taken at 3.33 for the Fteley-Stearns and Herschel formulas.

INCREASE OF HEAD BY SUBMERGED WEIRS.

Any of the submerged-weir formulas may be transformed into expressions giving the rise in water level caused by the construction of a submerged weir in a channel or canal; in this form they are most useful in the design of slack-water navigation works.

RANKINE'S FORMULAS.[a]

Weir not drowned, with flat or slightly rounded crest:

$$H=\triangle=\sqrt[3]{\frac{Q^2}{7L^2}}, \text{ approximate} \quad . \quad . \quad . \quad . \quad . \quad (82)$$

Weir drowned:

First approximation—

$$H'=\triangle+d$$

Second approximation—

$$H=H'-d\left(1-\frac{5}{4}\frac{d}{H'-d}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad (83)$$

[a] Civil Engineering, p. 699.

COLONEL DYAS'S FORMULA.[a]

This is intended to determine the height of a weir on the crest of a fall in an irrigation or other canal to maintain a desired uniform depth and slope.

D=Depth on weir, feet.
X=Depth of uniform channel, feet.
$P=X-D$=Height of weir necessary.
A=Area uniform channel section, feet.
R=Hydraulic radius, feet.
S=Slope or fall in feet, per foot.
L=Length of weir crest, feet.

$$D=\left(\frac{900A^2RS}{L^2}\right)^{\frac{1}{3}}-125.8122RS \quad . \quad . \quad . \quad . \quad (84)$$

If $A=1000$ $X=10'$ $R=8.33$ $S=0.001$ $L=100$,

$$D=\left[\frac{900\times1000^2\times8.33\times0.001}{10000}\right]^{\frac{1}{3}}-125.81\times8.33\times0.001$$

$$=9.0856-1.0441=8.04$$

$$P=10-8.04=1.96 \text{ feet.}$$

In this case length of weir equals width of channel, and the velocity of approach would be the mean velocity, which by Kutter's formula will vary, say, from 8 to 10 feet per second under the conditions, depending on the value of the coefficient of roughness n. This would make the flow in the channel 8,000 to 10,000 cubic feet per second.

As a check on the calculated depth D, it will be found that the flow over a weir 100 feet long under a head 8.04 feet (corrected for the large velocity of approach) will also be from, say, 8,000 to 10,000 cubic feet per second, depending upon the coefficient used in the weir formula.

SUBMERGED WEIRS OF IRREGULAR SECTION.

For certain forms of irregular weirs having vertical downstream faces, the discharge when subject to submergence may probably be approximated by applying the ratio of drowned to free discharge for a thin-edged weir similarly submerged as a correction to the coefficient for free discharge over the weir in question. For broad-crested weirs or weirs with aprons this method probably will not be applicable.

BAZIN'S EXPERIMENTS.

For many of the model weirs of irregular section for which free-discharge coefficients were obtained by Bazin, duplicate series of coefficients with various degrees of submergence were also obtained.

[a] *Wilson, H. M., Irrigation in India*: Twelfth Ann. Rept. U. S. Geol. Survey, 1890-91, pt. 2, p. 482.

Many of these data have been reduced to English units by Nelles.[a] Evidently each form of weir section will require a special formula or table of coefficients, and little more can be done than to refer to the original data for each specific case.

By way of general illustration of the character of submergence effect on weirs of irregular section, the writer has deduced the following roughly approximate formulas from Bazin's experiments on triangular weirs with vertical upstream faces and sloping aprons. The weirs were 2.46 feet high and the end contractions were suppressed. Coefficient curves for free discharge are given on Pl. V.

Three series are included:

Series 195, batter of face 1 : 1.
Series 196, batter of face 2 : 1.
Series 197, batter of face 5 : 1.

Experiments in which the proportional submergence $\frac{d}{D}$ was nearly the same were grouped, and the average values of $\triangle$, D, and d were determined. From these the mean values of $\frac{\triangle}{D}$ and $\frac{d}{D}$ were computed and platted and a straight-line formula deduced.

$$\left.\begin{aligned} \frac{\triangle}{D} &= 0.72 + b\left(1 - \frac{d}{D}\right) \\ b &= 0.08 + 0.17B. \end{aligned}\right\} \quad \ldots\ldots \quad (85)$$

The initial effect occurs when

$$\frac{d}{D} = \frac{0.17B - 0.20}{17B + 0.08} \quad \ldots\ldots\ldots \quad (86)$$

In the above formulas $\triangle$ is the *measured* head on a weir with free overflow, having the same form of cross section, that would give the same discharge. D is the depth on the submerged weir, d is the depth of submergence, and B is the batter or slope of the apron.

DATA CONCERNING EAST INDIAN WEIRS.

The following data compiled by Nelles[b] are derived from observations on actual dams under heads unusually great. The calculated coefficients in the ordinary weir formula (a)

$$Q = M' L H \sqrt{2gH},$$

in the theoretical submerged-weir formula (b)

$$Q = M' L \sqrt{2gZ}\left(d + \frac{2}{3}Z\right),$$

and in the Rhind formula (77) are given in columns 14, 13, and 12, respectively (p. 145), the observed head being corrected for velocity of approach.

[a] Trans. Am. Soc. C. E., vol. 44, pp. 359-383. [b] Loc. cit.

Data of submerged flow at certain large masonry dams in India.

Name of river.	Name of weir.	Make-up of weir.		Depth of crest below water surface in—		Observed fall over weir, feet.	Mean surface velocity of approach, in feet per second.	Corresponding velocity of head, feet.	Calculated discharge, in cubic feet per second.	Height of main body of weir, feet.	Coefficients of discharge in the various submerged-flow formulas.			Approximate section of weir.
		Description of parts.	Length of parts, in feet.	Upper pool, feet.	Lower pool, feet.						Rhind's (77).	Formula *b*, observed head.	Formula *a*, observed head.	
												Submerged weir.	Free weir.	
			L	D	d	$D-d=z$	v	$\frac{v^2}{2g}$	Q	p				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Brahmini	Pattia	Main body	665	19.21	18.35	0.86	7.84	0.96	114,000		0.881	0.806	0.241	
		First step	60	8.21	7.35									
		Second step	9	2.21	1.35									
Byturnee	Byturnee	Sluices	100	18.10	15.29	2.81			Total, 260,000	7.9	0.953	0.940	0.491	Fig. 13.
		Piers	14	7.68	4.87									
		Main body	912	10.84	8.03									
		Total overfall	1,026			1.13	8.51		For main body alone, 212,400	7.9	0.979	0.970	0.511	
Do	Burrah	Seines	100	18.60	15.20	3.40								
		Piers	14	8.18	4.78									
		Main body	412	11.34	7.94									Fig. 14.
		Total overfall	526											
Brahmini	Brahmini	Sluices	389	18.02	17.55	0.47	6.99	0.76		7.5				
		Piers	140	8.02	7.55									
		Main body	3,471	10.52	10.05				260,000		0.878	0.790	0.266	Same as Fig. 13.
		Total overfall	4,000						307,500		0.876	0.786	0.245	
Manhanuddy	Kajooree	Sluices	90	30.675	30.15	0.525	11.62	2.10		10.65				
		Breaches	324	25.615	25.09									
		Main body	3,433	20.115	19.59				680,000		0.893	0.764	0.261	Do.
		Total overfall	3,847						787,000		0.891	0.763	0.355	
Do	Manhanuddy	Shore sluices	190	17.45	15.45	2.00	7.74	0.93		6.0				
		Center sluices	460	17.20	15.20									
		Main body	5,696	11.45	9.45				488,000		0.595	0.561	0.265	Do.
		Total overfall	6,346						609,000		0.633	0.597	0.274	
Do	Beropa	Sluices	255	13.30	12.10	1.20	6.65	0.68		5.0				
		Piers	118	4.30	3.10									
		Main body	1,607	8.30	7.10				82,800		0.594	0.570	0.244	Do.
		Total overfall	1,980						112,700		0.648	0.677	0.260	

UNITED STATES DEEP WATERWAYS EXPERIMENTS.[a]

These experiments were made in 1899 at Cornell University hydraulic laboratory on a model having completely rounded profile, being a design for a submerged dam for regulation of Lake Erie.

The coefficient curve for free discharge is given on Pl. XVI. The absolute coefficients and the relative discharge with various degrees of submergence are shown below. The depth (D) above the weir was 6.6 feet. The Francis formula is used.

$$Q = C' L H^{\frac{3}{2}}.$$

Absolute coefficients.

$\frac{d}{D}$	Submergence from backwater.	C'
	Feet.	
0.0	0.00	3.70
.1	.66	3.67
.2	1.32	3.64
.3	1.98	3.60
.4	2.64	3.54
.5	3.30	3.47
.6	3.99	3.36
.7	4.62	3.17
.8	5.28	2.88
.9	5.94	2.30

Relative coefficients, United States Deep Waterways submerged-weir model.

$\frac{d}{D}$	$\frac{C'}{C}$	$\frac{d}{D}$	$\frac{C'}{C}$
0.0	1.000	0.5	0.937
.1	.991	.6	.907
.2	.983	.7	.856
.3	.972	.8	.778
.4	.956	.9	.621
		1.0	

C is the coefficient for free discharge over a similar weir under the same head.

WEIR DISCHARGE UNDER VARYING HEAD.

Problems of weir discharge under varying head occur in the design of storage reservoirs, and in determining the maximum discharge of streams.

[a] Rept. U. S. Board of Engineers on Deep Waterways, pt. 1, p. 291.

i effort has been made in the present chapter to record the various ing formulas resulting from the solution of this mathematically ult portion of the theory of the weir, and to give numerical data cilitate calculations.

is assumed that there is no velocity of approach, or, if any, that the has been corrected therefor. The weir coefficient is also assumed ntinue constant through the range of variation of the head.

tation:

T = Time in seconds required for the head to change between two assigned values.

H_o = Initial depth on weir, feet.

H_t = Depth on weir at the time t.

S = Reservoir surface area, square feet.

L = Length of overflow weir, feet.

I = Rate of inflow to reservoir, cubic feet per second.

Q = Rate of outflow at time t.

MATIC RESERVOIR, NO INFLOW, TIME REQUIRED TO LOWER WATER SURFACE FROM H_o TO H_t.[a]

$$dQ = CLH^{\frac{3}{2}}dt = -SdH$$

$$dt = -\frac{S}{CLH^{\frac{3}{2}}}dH$$

$$\int_0^T dt = -\frac{S}{CL}\int_{H_o}^{H_t} H^{-\frac{3}{2}}dH$$

$$T = \frac{2S}{CL}\left(\frac{1}{\sqrt{H_t}} - \frac{1}{\sqrt{H_o}}\right) \quad . \quad . \quad . \quad . \quad . \quad (87)$$

re $$C = \frac{2}{3}M\sqrt{2g} = 5.35\ M$$

$T = \infty$, when $H_t = 0$.

$= 1{,}000{,}000$, $H_o = 4$, $H_t = 0.1$, $C = 3.33$, and $L = 100$,

$$T = \frac{2}{100} \times \frac{3{,}000{,}000}{10}\left(\frac{\sqrt{10}}{1} - \frac{1}{2}\right) = 15{,}972 \text{ seconds} = 4.44 \text{ hours.}$$

lower the reservoir from $H = 4$ to $H = 1$ would require 3,000 ids.

ROXIMATE TIME OF LOWERING PRISMATIC OR NONPRISMATIC RESERVOIR.

oosing small successive values of $H_o - H_t$, we may solve this lem approximately, as shown in the following table:

) required to lower reservoir from H_o to $H_t = \frac{(H_o - H_t)\ S}{\text{Mean } Q}$ (88)

[a] Des Ingenieurs Taschenbuch, I, 1902, p. 230.

We may take the mean discharge between the narrow limits H_o and H_t,

$$Q_m = \frac{CL}{2}\left(H_o^{\frac{3}{2}} + H_t^{\frac{3}{2}}\right) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (89)$$

or, using the average head,

$$Q_m = CL\left(\frac{H_o + H_t}{2}\right)^{\frac{3}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (90)$$

In the following example we have used the latter value, and have made $H_o - H_t = 0.5$ foot. A similar solution may be made for a non-prismatic reservoir, using successive values of $\frac{S_1 + S_2}{2}$ as the reservoir area, and determining the increments of T by formula (88).

Example of varying discharge.

H_o	H_t	Average H	Q per second.	$\frac{1000}{Q}$	T for increment $H_o - H_t$.	Total T, in seconds.
4.0	3.5	3.75	2,417.0	0.4137	207	207
3.5	3.0	3.25	1,951.0	.5126	256	463
3.0	2.5	2.75	1,519.0	.6580	330	793
2.5	2.0	2.25	1,124.0	.8970	448	1,241
2.0	1.5	1.75	771.0	1.2970	650	1,891
1.5	1.0	1.25	465.4	2.1500	1,070	2,961

The total time required in seconds is 2,961, as compared with 3,000 by formula (87).

The time required, using the average Q instead of the average H in the calculation, that is, using formula (89) instead of (90), is 2,933.5 seconds.

The time T is directly proportional to the area of storage surface and inversely proportional to the length of spillway. It is also usually proportional to the value of C in the weir formula.

RESERVOIR PRISMATIC, WITH UNIFORM INFLOW.[a]

GENERAL FORMULAS.

Starting with reservoir full to crest level, $H_o = 0$, to find the time required for the depth of overflow to reach a given stage, H_t.

[a] Mullins, Lieut. Gen. J., Irrigation Manual, Madras Govt., 1890, App. V, pp. 214-223.

When individual values of the increment H_2-H_1 are small, not over 0.5 foot each, if successive values are taken, we have approximately:

$$t=\frac{S(H_2-H_1)}{I-\frac{Q_1+Q_2}{2}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (91)$$

$$I=\frac{2(H_2-H_1)S+Q_1+Q_2}{2t} \quad . \quad . \quad . \quad . \quad . \quad (92)$$

t=time required to rise through the increment H_2-H_1.

A summation of the successive values of t required for the water to rise each increment will give the total time of rise from H_o to H_t. Formula (92) will give the maximum run-off from a catchment area tributary to a reservoir if two successive values of H and the corresponding value of t are known.

Formula (92) may also be used to determine T for a nonprismatic reservoir with a variable rate of inflow by choosing such increments, H_2-H_1, that the average values of S, I, and Q will be nearly correct. Variations in the weir coefficient C may also be considered.

FORMULAS FOR TIME OF RISE TO ANY HEAD H, PRISMATIC RESERVOIR WITH UNIFORM INFLOW.

Several analytical solutions of this problem have been made. Starting at spillway level, let H_a equal the depth of overflow corresponding to the quantity of inflow I. The problem is stated by the following differential equation whose primitive is required:

(Rate inflow—rate outflow) $dt=d$ (increase in storage), or

$$(I-CLH^{\frac{3}{2}})\,dt=SdH \quad . \quad . \quad . \quad . \quad . \quad . \quad (93)$$

In the solution, mathematical substitutions are necessary in order to render the time-outflow equation integrable in known forms. A very clear demonstration for a special value of C has been given by Frizell.[a] By modifying Frizell's formula to adapt it to the use of any value of C in the weir formula, the following equation is obtained:

$$\frac{3CLb}{2S}T=\text{nat. log}\sqrt{\frac{H+b\sqrt{H}+b^2}{b-\sqrt{H}}}+\sqrt{3}\tan^{-1}\sqrt{\frac{1}{3}}-\sqrt{3}\tan^{-1}\frac{2\sqrt{H}+b}{b\sqrt{3}} \quad (94)$$

where $b=\sqrt[3]{\frac{I}{CL}}$

When $H=H_a$, the second member becomes the sum of an infinite and two finite quantities, T is then infinite, and the outflow can never

[a] Water Power, pp. 200-203.

become equal to the inflow, or H can never equal H_a, which quantity it approaches as a limit as T increases. Frizell places $H=rH_a$, r having any value less than unity, and, being very nearly unity, $\sqrt{r}$ will be more nearly so, and is taken as equal to unity, without great error, enabling the two inverse trigonometric constants to be evaluated in terms of arc, giving finally:

$$T=\frac{2S}{3(C^2L^2I)^{\frac{1}{3}}}\left(\text{nat. log}\ \frac{\sqrt{1+\sqrt{r}+r}}{1-\sqrt{r}}-0.88625\right) \quad . \quad . \quad (95)$$

Nat. log $N=2.302585\ \log_{10} N$

E. Ludlow Gould[a] gives the following formula, identical with the above except in the form of the constant of integration:

$$T=\frac{2S}{3(C^2L^2I)^{\frac{1}{3}}}\left[\text{nat. log}\ \frac{\sqrt{1+\sqrt{r}+r}}{1-\sqrt{r}}-\sqrt{3}\left\{\tan^{-1}\frac{2}{\sqrt{3}}\left(\frac{1}{2}+\sqrt{r}\right)-\frac{\pi}{6}\right\}\right] \quad . \quad . \quad . \quad . \quad (96)$$

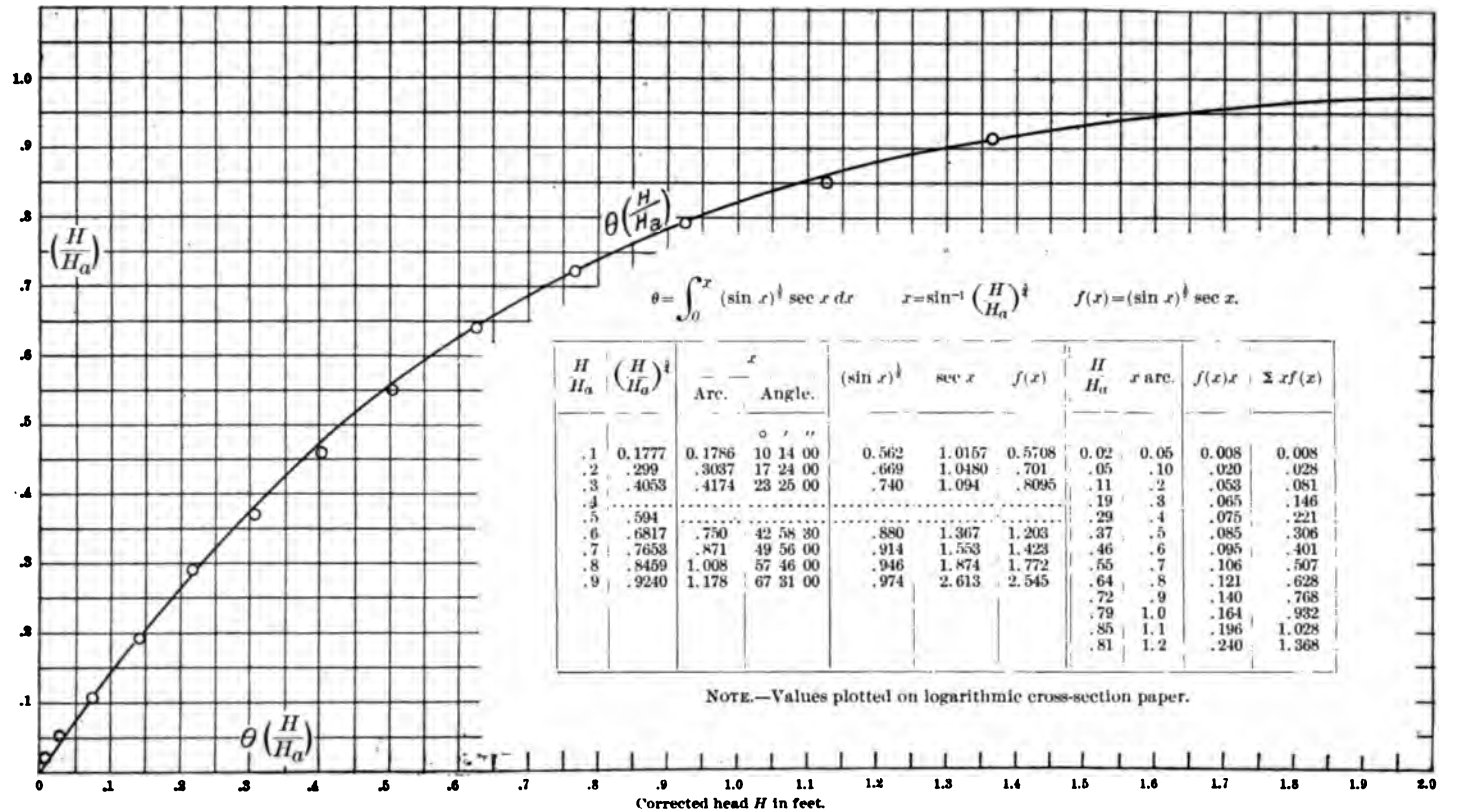
$r=\frac{H}{H_a}$ as before. Gould does not consider $\sqrt{r}$ constant, but derives the values of the function in brackets for various values of r, from which the following table has been derived:

$$\phi=\left[\text{nat. log}\ \frac{\sqrt{1+\sqrt{r}+r}}{1-\sqrt{r}}-\sqrt{3}\left\{\tan^{-1}\frac{2}{\sqrt{3}}\left(\frac{1}{2}+\sqrt{r}\right)-\frac{\pi}{6}\right\}\right] \quad . \quad (97)$$

Values of ϕ, Gould's formula.

$\frac{H}{H_a}$	0	1	2	3	4	5	6	7	8	9
0.0	0.0000	0.0153	0.0306	0.0459	0.0613	0.0766	0.0919	0.1072	0.1226	0.1378
.1	.1532	.16854	.1838	.1992	.2155	.2319	.2483	.2646	.2810	.2973
.2	.3137	.3301	.3464	.3628	.3791	.3955	.4137	.4319	.4501	.4683
.3	.4865	.5047	.5229	.5411	.5593	.5775	.5957	.6139	.6321	.6534
.4	.6747	.6960	.7173	.7386	.7598	.7811	.8024	.8237	.8450	.8663
.5	.8876	.9137	.9399	.9660	.9921	1.0183	1.0444	1.0705	1.0966	1.1128
.6	1.1489	1.1750	1.2012	1.2322	1.2674	1.3027	1.3380	1.3733	1.4086	1.4439
.7	1.4792	1.5145	1.5498	1.5851	1.6203	1.6556	1.7073	1.7590	1.8107	1.8624
.8	1.9141	1.9658	2.0176	2.0715	2.1488	2.2262	2.3035	2.3808	2.4582	2.5355
.9	2.6129	2.7681	2.9233	3.0785	3.2347	3.3889	3.5441	4.0096	4.4750	4.9405

[a] Engineering News, Dec. 5, 1901, pp. 430–431.



$$\theta = \int_0^x (\sin x)^{\frac{1}{2}} \sec x \, dx \qquad x = \sin^{-1}\left(\frac{H}{H_a}\right)^{\frac{1}{2}} \qquad f(x) = (\sin x)^{\frac{1}{2}} \sec x.$$

$\frac{H}{H_a}$	$\left(\frac{H}{H_a}\right)^{\frac{1}{2}}$	x Arc.	x Angle.	$(\sin x)^{\frac{1}{2}}$	sec x	$f(x)$	$\frac{H}{H_a}$	x arc.	$f(x)x$	$\Sigma\, xf(x)$
			° ′ ″							
.1	0.1777	0.1786	10 14 00	0.562	1.0157	0.5708	0.02	0.05	0.008	0.008
.2	.299	.3037	17 24 00	.669	1.0480	.701	.05	.10	.020	.028
.3	.4053	.4174	23 25 00	.740	1.094	.8095	.11	.2	.053	.081
.4							.19	.3	.065	.146
.5	.594						.29	.4	.075	.221
.6	.6817	.750	42 58 30	.880	1.367	1.203	.37	.5	.085	.306
.7	.7653	.871	49 56 00	.914	1.553	1.423	.46	.6	.095	.401
.8	.8459	1.008	57 46 00	.946	1.874	1.772	.55	.7	.106	.507
.9	.9240	1.178	67 31 00	.974	2.613	2.545	.64	.8	.121	.628
							.72	.9	.140	.768
							.79	1.0	.164	.932
							.85	1.1	.196	1.028
							.81	1.2	.240	1.368

NOTE.—Values plotted on logarithmic cross-section paper.

DIAGRAM OF VARIABLE DISCHARGE.

We may write formula (9)

$$T=\phi\left(\frac{H}{H_a}\right)\times\frac{2S}{3\sqrt[3]{C^2L^2I}} \quad . \quad . \quad . \quad . \quad . \quad . \quad (98)$$

R. S. Woodward suggests the formula [a]

$$\left.\begin{aligned} T&=\frac{4S}{3\sqrt[3]{C^2L^2I}}\int_0^X(\sin X)^{\frac{1}{3}}\sec X dX \\ \text{where}\quad X&=\sin^{-1}\sqrt{\frac{CLH^{\frac{3}{2}}}{I}}=\sin^{-1}\left(\frac{H}{H_a}\right)^{\frac{3}{4}} \end{aligned}\right\} \quad . \quad . \quad . \quad (99)$$

This, like the preceding expressions, becomes infinity when the integral is carried over the entire range $X=0$ to $X=\frac{\pi}{2}$, conforming with the physical conditions.

The writer has evaluated this function for finite values of $\frac{H}{H_a}$ by mechanical quadrature, as shown in the diagram, Pl. XXXVIII. The diagram illustrates the rapid rise until a head closely approaching H_a is attained, occupying a comparatively short time interval, while for further increments of head the time interval is relatively very great.

E. Sherman Gould [b] gives the same integral developed as an infinite series

$$T=\frac{2SH}{I}\left[\frac{1}{2}+\frac{K}{5}+\frac{K^2}{8}+\cdots\cdots+\frac{K^n}{2+3_n}\right] \quad . \quad . \quad (100)$$

where $$K=\left(\frac{H}{H_a}\right)^{\frac{3}{4}}.$$

$$\text{If } \vartheta\left(\frac{H}{H_a}\right)=\left[\frac{K^0}{2}+\frac{K^1}{5}+\frac{K^2}{8}+\cdots\cdots+\frac{K^n}{2+3_n}\right]$$

$$T=\frac{2SH}{I}\times\vartheta\left(\frac{H}{H_a}\right)=\frac{2S}{\sqrt[3]{C^2L^2I}}\vartheta\left(\frac{H}{H_a}\right) \quad . \quad (101)$$

[a] Engineering News, December 5, 1901, p. 431.
[b] Engineering News, November 14, 1901, pp. 362-363.

If we write

$$F=\frac{2S}{3\sqrt[3]{C^2L^2I}},$$

then Frizell's formula may be written $T=F\times\rho\left(\frac{H}{H_a}\right)$

E. L. Gould's formula may be written $T=F\times\phi\left(\frac{H}{H_a}\right)$

Woodward's formula may be written $T=2F\psi\left(\frac{H}{H_a}\right)$

E. Sherman Gould's formula may be written $T=F\times\vartheta\left(\frac{H}{H_a}\right)$. (102)

The formulas are therefore identical, the transcendental factor bearing the relation,

$$\rho\left(\frac{H}{H_a}\right)=\phi\left(\frac{H}{H_a}\right)=2\psi\left(\frac{H}{H_a}\right)=\vartheta\left(\frac{H}{H_a}\right)$$

The E. L. Gould, Woodward, and E. S. Gould formulas are applicable for any value of the ratio $\frac{H}{H_a}$. That of Frizell can be strictly applied only when $\frac{H}{H_a}$ is nearly unity. In the E. S. Gould formula $\vartheta\left(\frac{H}{H_a}\right)$ converges very slowly as the argument approaches unity.

For rough calculations E. S. Gould gives the rule

$$TI-TCL(\mu H)^{\frac{3}{2}}=SH$$

where μ is the coefficient in the weir formula for reducing final head to mean head.

$$T=\frac{SH}{I-CL(\mu H)^{\frac{3}{2}}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (103)$$

The ratio μ of the constant mean head which would give the total discharge SH in the time T he finds by trial.

E. S. Gould gives the values

$\mu=0.67$ for small values of H
to $\mu=0.75$ for large values of H.

Comparing the formulas,

Let $S=1{,}000{,}000$ square feet

$C=3.33=\frac{10}{3}$

$L=100$

$I=10{,}000$ cubic feet per second

$H_a=\left(\frac{I}{CL}\right)^{\frac{2}{3}}=30^{\frac{2}{3}}=9.655$ feet.

Required the time to rise to a height $H_a=0.9H=8.6895$ feet.

$$F=\frac{2S}{3\sqrt[3]{C^2L^2I}}=643.5$$

Frizell	(95)	$T=1677.6$ seconds.
E. L. Gould	(96)	$T=1681.5$ seconds.
Woodward	(99)	$T=1660.2$ seconds.
E. S. Gould (approximate)	(103)	$T=1488.3$ seconds.

The difference in the value of T by the first three formulas represents the difference in the values of the transcendental portions of the equations as evaluated by different methods.

The time required to rise from H_a to H_b will be the difference of the times T_1 and T_2 by the above formulas.

NONPRISMATIC RESERVOIR, UNIFORM INFLOW.

P. P. L. O'CONNELL.[a]

Representing the reservoir by a cone having its apex at distance A, below plane of the overflow,

$$\left.\begin{array}{ll}\text{Area at overflow level} & =S_0=\pi(\alpha A)^2\\ \text{Area at any other level} & =S=\pi[\alpha(A+H)]^2\end{array}\right\} \quad . \quad . \quad . \quad . \quad . \quad . \quad (104)$$

where α is the slope of the sides, or where there is α foot horizontal run to 1 foot vertical rise. From (104) with S_0 and α given, A may be determined.

Where the factor $$I_1=\sqrt[3]{\frac{I}{CL}},$$

$$T=\frac{\pi\alpha^2}{CL}\left[-4A\sqrt{H}-\frac{2}{3}H^{\frac{3}{2}}-\frac{2}{3}I_1^3\ \text{nat. log}\frac{I_1^3-H^{\frac{3}{2}}}{I_1^3}\right.$$

$$-\frac{(2AI_1^2+A^2)}{3I_1}\ \text{nat. log}\left(\frac{[\sqrt{H}-I_1]^2}{H+I_1\sqrt{H}+I_1^2}\right)$$

$$\left.+\frac{2A^2-4AI_1^2}{3I_1}\ \sqrt{3}\tan^{-1}\left(\frac{-\sqrt{3}H}{2I_1+\sqrt{H}}\right)\right] \quad . \quad . \quad (105)$$

[a] Mullins's Irrigation Manual.

E. L. GOULD.[a]

Calling i the angle of inclination of the banks, P_o the perimeter, at spillway level, exclusive of overflow,

$$S=S_o+BH+B_1H^2 \text{ where } B=P_o \cot i$$

$$B_1=\pi \cot i^2 \quad r=\frac{H}{H_1}$$

$$T=\frac{2}{3I^{\frac{1}{3}}C^2L^2}\left[\left(S_o(CL)^{\frac{4}{3}}+B(ICL)^{\frac{2}{3}}\right)\text{nat. log}\frac{\sqrt{1+\sqrt{r}+r}}{1-\sqrt{r}}\right.$$

$$-\left(S_o(CL)^{\frac{4}{3}}-B(ICL)^{\frac{2}{3}}\right)\sqrt{3}\left\{\tan^{-1}\frac{1+2\sqrt{r}}{\sqrt{3}}-\frac{\pi}{6}\right\}$$

$$\left.-B_1I^{\frac{4}{3}}\left\{\text{nat. log }(1-r^{\frac{3}{2}})+r^{\frac{3}{2}}\right\}-B(ICL)^{\frac{2}{3}}\sqrt{r}\right] \quad . \quad (106)$$

For $i=90°$ and $B=0$, the above formula reduces to (96), the equation for a prismatic reservoir.

VARIABLE INFLOW, NONPRISMATIC RESERVOIR.

This problem may be solved by dividing the reservoir into successive levels, and solving by the formulas previously given, as if each layer represented a portion of a reservoir with a constant inflow equal to the average rate, or if the formulas for prismatic reservoir are used, then each layer will be supposed to represent a portion of a prismatic reservoir of area equal to the average area of the layer.

Mullins's formula may often be more conveniently used and a better solution be obtained than by attempting to average the area and inflow, as would be necessary to apply the analytical formulas given.

The general differential equation for rise in time T with a variable inflow and reservoir area is

$$(I-Q)\,dT=S\,dH \quad . \quad . \quad . \quad . \quad . \quad . \quad (107)$$

If we can express I as a function of T, and S and Q as functions of H, and integrate between the limits $H=0$, $H=H_1$, we may obtain an equation between H and T similar to those given for prismatic reservoirs with constant inflow.

We may write the ordinary weir formula,

$$Q=CLH^{\frac{3}{2}}.$$

[a] Loc. cit.

The area S can usually be readily expressed in terms of the area at crest level and slope of the reservoir sides (assumed constant within the narrow limits 0, H); the inflow I often increases nearly as a linear function of T while a stream is rising rapidly; we have, then,

$$Q_t = CLH^{\frac{3}{2}}$$
$$S_t = S_0 + 2\alpha\sqrt{S_0}H + \alpha^2H^2$$
$$I_t = I_0 + fT.$$

Substituting in (107)

$$\left(I_0 + fT - CLH^{\frac{3}{2}}\right)dT = \left(S_0 + 2\alpha\sqrt{S_0}H + \alpha^2H^2\right)dH \quad . \quad (108)$$

The complete primitive of this differential equation can be determined only as an infinite series.[a]

Rivers during flood usually rise rapidly and fall slowly. The time-inflow function can sometimes be approximated by a modified sinusoid.

$$I = I_0 + I_m \sin (bt)^{\frac{1}{n}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (109)$$

where $n =$ or > 1

T=Total duration of flood.

I_m=Maximum rate of inflow.

T_m=Time elapsed from beginning of rise to maximum.

The constants are so chosen that the arc value of the duration of the flood from stage I_0 through to the same stage is π, or,

$$(bt)^{\frac{1}{n}} = \pi \qquad b = \frac{\pi^n}{T} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (110)$$

For the maximum we will have, differentiating (109),

$$\cos (bT_m)^{\frac{1}{n}} = 0, \qquad \text{or } (bT_m)^{\frac{1}{n}} = \frac{\pi}{2} \quad . \quad . \quad . \quad (111)$$

$$\text{or } b = \frac{1}{T_m}\left(\frac{\pi}{2}\right)^n = \frac{\pi^n}{T} \qquad \text{or} \qquad \frac{T}{T_m} = 2^n$$

$$n = \log \frac{T}{T_m} \times \frac{1}{\log 2} = 3.32204 \log \left(\frac{T}{T_m}\right) \quad . \quad . \quad . \quad (112)$$

common logarithms being used.

If $T = 1000$ and if $T_m = 200$, then $n = 3.322 \log 5 = 2.322$,

$$b = \frac{\pi^{2.322}}{1000} = 0.0143, \text{ and } \frac{1}{n} = 0.43066$$

[a] Seddon, James A., C. E. (Proc. Am. Soc. C. E., vol. 24, June, 1898, pp. 559–598), has solved equation (108) for the Great Lakes reservoir system, assuming an annual cycle following the law $I = I_m + A \sin T$, I_m being the mean inflow and T the time arc on a circle whose circumference represents one year. He also assumes $Q = Q_0 + bH$, or a linear function of the height H.

Example of variable flood discharge computed by formula (109).

t, in seconds.	(bt)	log (bt)	$\log (bt)^{\frac{1}{n}}$	$(bt)^{\frac{1}{n}}$	Angle.	$\sin (bt)^{\frac{1}{n}}$
					° ′	
100	1.43	0.155336	0.06695	1.1667	66 55	0.9199
200	2.86	.456366	.196694	1.573	90 00	1.0000
300	4.29	.632457	.27259	1.8732	107 21	.9938
400	5.72	.757396	.32644	2.1206	121 08	.8560
500	7.15	.854306	.36820	2.3346	133 49	.7216
600	8.58	.933487	.40233	2.5254	144 42	.5779
700	10.01	1.000434	.43100	2.6978	155 00	.3907
800	11.44	1.058426	.45618	2.8588	163 52	.2779
900	12.87	1.109578	.47790	3.0054	172 12	.1320

The form of the graph of the flood may be determined by plotting the quantities in the last column of this table in terms of t. The resulting curve rises rapidly to a maximum when $t=200$, after which it descends slowly.

TABLES FOR CALCULATIONS OF WEIR DISCHARGE.

The investigations at Cornell University have greatly extended the limit for which weir coefficients are definitely known. The experiments of Bazin did not reach beyond 1.8 feet head maximum. The tables of Francis for thin-edged weirs extended to a head of 3 feet.

The experiments at Cornell have furnished the coefficients for a variety of weir forms for heads up to 4, 5, and 6 feet. At such heads the nappe form has become stable for nearly all forms of weirs. We may now predict the probable extension of the coefficient curves for higher heads with more confidence than could be done by starting from a lower datum.

Owing to their usefulness in the approximate determination of flood discharges, the weir tables have been carried up to a head of 10 feet.

In the tables here given the head is uniformly expressed in feet. For computing the flow over irrigation modules and other small weirs where the head is measured in inches, weir tables expressed with the inch as the argument of head are convenient. Numerous tables of this character are available. The following may be referred to:

The Emerson weir tables, computed by Charla A. Adams, pages 251–285 of Emerson's Hydrodynamics, published by J. and W. Jolly, Holyoke, Mass. These give discharge in cubic feet per minute for weirs with two end contractions having lengths of 2, 3, 4, 5, 6, 7, 8, 10, 12, 16, and 20 feet. The discharge is computed by the Francis formula for heads from 0.001 foot to 2 feet, advancing by thousandths of a foot, with auxiliary table of decimal equivalents of fractional parts of inches.

The Measurement and Division of Water, Bulletin No. 27, Agricultural Experiment Station, Fort Collins, Colo. This publication gives tables of discharge in cubic feet per second, computed by the Francis formula, for a weir 1 foot long, for heads in inches and sixteenths, from $\frac{1}{16}$ inch to 30 inches, with auxiliary table for end contractions, and for velocity of approach correction by the Fteley and Stearns rule ($H=D+\frac{1}{2}h$). A similar weir table for a weir 1 inch long is given. Also a table of discharge for Cippoletti weirs ($C=3.36\frac{1}{2}$), for lengths of crest sill of 1, 1.5, 2, 3, 4, 5, and 10 feet. Head in inches and decimals with feet equivalents.

Special Instructions to Watermasters as to Measurements of Water, State Engineer's Office, Salt Lake City, Utah, 1896. Table of discharge, in cubic feet per second, for 1-foot crest, based on the Francis formula, with auxiliary table for end contractions and velocity of approach. The head is expressed in inches and thirty-seconds (with equivalents in feet) for $\frac{1}{32}$ inch to 36 inches. A similar table for heads in inches and sixteenths, from $\frac{1}{16}$ to 36 inches, gives the discharge in cubic feet per second by the Francis formula for weirs with two end contractions and for the crest lengths of 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 feet. A table for trapezoidal weirs ($C=3.367$) of various crest lengths is also given.

California Hydrography, by J. B. Lippincott, Water-Supply Paper No. 81, United States Geological Survey. This publication contains a table of weir discharge in cubic feet per second for heads, advancing by sixteenths, from $\frac{1}{16}$ inch to 10 inches (with equivalent decimals of a foot), for weirs with two end contractions having crest lengths as follows: 4, 6, 9, 12, 15, and 18 inches, 2, 2.5, 3, 3.5, 4, 4.5, 5, 6, 7, 8, 9, 10, 12, 14, 16, 18, and 20 feet. Based on the Francis formula. Also published as a circular.

The tables that follow are all original computations, with exception of tables 9–18, which were computed by E. C. Murphy, the "Francis weir tables," page 162, and the table of head due to various velocities, page 158.

TABLE 1.—HEAD DUE TO VARIOUS VELOCITIES.[a]

This table gives values of the expression

$$h=\frac{v^2}{2g},$$

based on the constant of gravity for the latitude and altitude of Lowell, Mass.,

$$g=32.1618,\ \frac{1}{2g}=0.01554639.$$

[a] Francis, Lowell Hydraulic Experiments, extended.

TABLE 1.—*Values of* $h=\frac{v^2}{2g}$, *or heads due to velocities from 0 to 4.99 feet per second.*

v	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001
.1	.0002	.0002	.0002	.0003	.0003	.0003	.0004	.0004	.0005	.0006
.2	.0006	.0007	.0008	.0008	.0009	.0010	.0011	.0011	.0012	.0013
.3	.0014	.0015	.0016	.0017	.0018	.0019	.0020	.0021	.0022	.0024
.4	.0025	.0026	.0027	.0029	.0030	.0031	.0033	.0034	.0036	.0037
.5	.0039	.0040	.0042	.0044	.0045	.0047	.0049	.0051	.0052	.0054
.6	.0056	.0058	.0060	.0062	.0064	.0066	.0068	.0070	.0072	.0074
.7	.0076	.0078	.0081	.0083	.0085	.0087	.0090	.0092	.0095	.0097
.8	.0099	.0102	.0105	.0107	.0110	.0112	.0115	.0118	.0120	.0123
.9	.0126	.0129	.0132	.0134	.0137	.0140	.0143	.0146	.0149	.0152
1.0	0.0155	0.0159	0.0162	0.0165	0.0168	0.0171	0.0175	0.0178	0.0181	0.0185
.1	.0188	.0192	.0195	.0199	.0202	.0206	.0209	.0213	.0216	.0220
.2	.0224	.0228	.0231	.0235	.0239	.0243	.0247	.0251	.0255	.0259
.3	.0263	.0267	.0271	.0275	.0279	.0283	.0288	.0292	.0296	.0300
.4	.0305	.0309	.0313	.0318	.0322	.0327	.0331	.0336	.0341	.0345
.5	.0350	.0354	.0359	.0364	.0369	.0374	.0378	.0383	.0388	.0393
.6	.0398	.0403	.0408	.0413	.0418	.0423	.0428	.0434	.0439	.0444
.7	.0449	.0455	.0460	.0465	.0471	.0476	.0482	.0487	.0493	.0498
.8	.0504	.0509	.0515	.0521	.0526	.0532	.0538	.0544	.0549	.0555
.9	.0561	.0567	.0573	.0579	.0585	.0591	.0597	.0603	.0609	.0616
2.0	0.0622	0.0628	0.0634	0.0641	0.0647	0.0653	0.0660	0.0666	0.0673	0.0679
.1	.0686	.0692	.0699	.0705	.0712	.0719	.0725	.0732	.0739	.0746
.2	.0752	.0759	.0766	.0773	.0780	.0787	.0794	.0801	.0808	.0815
.3	.0822	.0830	.0837	.0844	.0851	.0859	.0866	.0873	.0881	.0888
.4	.0895	.0903	.0910	.0918	.0926	.0933	.0941	.0948	.0956	.0964
.5	.0972	.0979	.0987	.0995	.1003	.1011	.1019	.1027	.1035	.1043
.6	.1051	.1059	.1067	.1075	.1084	.1092	.1100	.1108	.1117	.1125
.7	.1133	.1142	.1150	.1159	.1167	.1176	.1184	.1193	.1201	.1210
.8	.1219	.1228	.1236	.1245	.1254	.1263	.1272	.1281	.1289	.1298
.9	.1307	.1316	.1326	.1335	.1344	.1353	.1362	.1371	.1381	.1390
3.0	0.1399	0.1409	0.1418	0.1427	0.1437	0.1446	0.1456	0.1465	0.1475	0.1484
.1	.1494	.1504	.1513	.1523	.1533	.1543	.1552	.1562	.1572	.1582
.2	.1592	.1602	.1612	.1622	.1632	.1642	.1652	.1662	.1673	.1683
.3	.1693	.1703	.1714	.1724	.1734	.1745	.1755	.1766	.1776	.1787
.4	.1797	.1808	.1818	.1829	.1840	.1850	.1861	.1872	.1883	.1894
.5	.1904	.1915	.1926	.1937	.1948	.1959	.1970	.1981	.1992	.2004
.6	.2015	.2026	.2037	.2049	.2060	.2071	.2083	.2094	.2105	.2117
.7	.2128	.2140	.2151	.2163	.2175	.2186	.2198	.2210	.2221	.2233
.8	.2245	.2257	.2269	.2280	.2292	.2304	.2316	.2328	.2340	.2352
.9	.2365	.2377	.2389	.2401	.2413	.2426	.2438	.2450	.2463	.2475
4.0	0.2487	0.2500	0.2512	0.2525	0.2537	0.2550	0.2563	0.2575	0.2588	0.2601
.1	.2613	.2626	.2639	.2652	.2665	.2677	.2690	.2703	.2716	.2729
.2	.2742	.2755	.2769	.2782	.2795	.2808	.2821	.2835	.2848	.2861
.3	.2875	.2888	.2901	.2915	.2928	.2942	.2955	.2969	.2982	.2996
.4	.3010	.3023	.3037	.3051	.3065	.3079	.3092	.3106	.3120	.3134
.5	.3148	.3162	.3176	.3190	.3204	.3218	.3233	.3247	.3261	.3275
.6	.3290	.3304	.3318	.3333	.3347	.3362	.3376	.3390	.3405	.3420
.7	.3434	.3449	.3463	.3478	.3493	.3508	.3522	.3537	.3552	.3567
.8	.3582	.3597	.3612	.3627	.3642	.3657	.3672	.3687	.3702	.3717
.9	.3733	.3748	.3763	.3779	.3794	.3809	.3825	.3840	.3856	.3871

This value will suffice in ordinary corrections for velocity of approach for localities in the United States.

Velocity of approach correction.

Francis, and as used in portions of this paper (approximate)	$H=D+h$
Fteley and Stearns, contracted weir	$H=D+1.5h$
Hamilton Smith, suppressed weir	$H=D+1\frac{1}{2}h$
Hamilton Smith, contracted weir	$H=D+1.4h$

TABLE 2.—PERCENTAGE INCREASE IN DISCHARGE BY VARIOUS RATES OF VELOCITY OF APPROACH.

This table has been calculated from the Francis correction formula,

$$H^{\frac{3}{2}}=(D+h)^{\frac{3}{2}}-h^{\frac{3}{2}}.$$

The percentage increase in discharge over that at the same measured head with no velocity of approach is

$$\text{Percentage}=100\frac{H^{\frac{3}{2}}-D^{\frac{3}{2}}}{D^{\frac{3}{2}}}=K \quad . \quad . \quad . \quad . \quad (113)$$

TABLE 2.—*Percentage increase in discharge over weirs for various rates of mean velocity of approach.*

D=measured head in feet; H=head corrected for velocity of approach; v=mean velocity of approach, feet per second; $h=\frac{v^2}{2g}$; $H=\left[(D+h)^{\frac{3}{2}}-h^{\frac{3}{2}}\right]^{\frac{2}{3}}$.

v	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1	2.2
h	0.0025	0.0039	0.0056	0.0076	0.0099	0.0126	0.0155	0.0188	0.0224	0.0263	0.0305	0.0350	0.0398	0.0449	0.0504	0.0561	0.0622	0.0686	0.0752
$h^{\frac{3}{2}}$	0.0002	0.0003	0.0005	0.0007	0.0010	0.0014	0.0019	0.0025	0.0033	0.0041	0.0051	0.0064	0.0079	0.0095	0.0111	0.0132	0.0154	0.0179	0.0206
D	Percentage increase in discharge $=100\left[1-\frac{H^{\frac{3}{2}}}{D^{\frac{3}{2}}}\right]$																		
0.2	1.36	2.65	3.72	5.02	6.44	8.16	9.77	12.19	14.13	16.34	18.62	20.80	22.51	25.39	27 74	30.78	33.55	36.30	39.06
.4	.68	1.34	1.90	2.58	3.33	4.20	5.11	6.16	7.20	8.39	9.62	10.86	12.16	13.54	14.94	16.53	18.11	19.72	21.34
.6	.42	.90	1.29	1.74	2.22	2.86	3.44	4.14	4.88	5.69	6.56	7.49	8.40	9.33	10.42	11.49	12.57	13.72	14.86
.8	.40	.62	.92	1.26	1.62	2.11	2.66	3.12	3.70	4.33	4.98	5.67	6.45	7.14	7.97	8.88	9.66	10.56	14.76
1.0	.36	.56	.79	1.07	1.40	1.76	2.15	2.59	3.05	3.56	4.10	4.66	5.24	5.86	6.54	7.21	7.98	8.68	9.43
1.5	.24	.37	.53	.72	.94	1.19	1.45	1.75	2.07	2.43	2.79	3.22	3.50	4.01	4.48	4.94	5.45	5.96	6.49
2.0	.19	.29	.41	.59	.72	.91	1.11	1.34	1.58	1.84	2.13	2.42	2.72	3.06	3.42	3.78	4.17	4.57	4.98
2.5	.18	.22	.31	.43	.56	.71	.88	1.06	1.25	1.47	1.70	1.94	2.19	2.45	2.75	3.04	3.36	3.68	3.95
3.0	.12	.19	.27	.36	.47	.60	.74	.89	1.06	1.24	1.43	1.63	1.84	2.07	2.31	2.56	2.83	3.10	3.38
3.5	.10	.16	.23	.31	.40	.47	.63	.76	.90	1.06	1,23	1.40	1.58	1.78	1.99	2.21	2.48	2.67	2.93
4.0	.09	.14	.20	.27	.35	.45	.55	.67	.80	.93	1.08	1.23	1.39	1.57	1.75	1.94	2.14	2.36	2.57
4.5	.08	.12	.18	.24	.31	.40	.49	.60	.71	.83	.96	1.10	1.24	1.40	1.56	1.78	1.92	2.10	2.30
5.0	.07	.11	.16	.22	.27	.35	.44	.54	.65	.75	.88	.98	1.12	1.26	1.42	1.57	1.64	1.90	2.07
5.5	.06	.10	.14	.20	.27	.33	.40	.49	.58	.68	.78	.90	1.00	1.15	1.28	1.43	1.57	1.73	1.90
6.0	.06	.09	.13	.17	.23	.30	.37	.45	.53	.63	.72	.84	.94	1.05	1.18	1.31	1.45	1.59	1.74
6.5	.06	.08	.12	.17	.22	.28	.34	.41	.49	.58	.67	.76	.87	.98	1.12	1.21	1.34	1.47	1.61
7.0	.05	.08	.11	.15	.20	.26	.32	.39	.46	.54	.63	.72	.80	.91	1.02	1.13	1.25	1.37	1.50
7.5	.04	.07	.10	.14	.18	.24	.29	.36	.43	.50	.58	.66	.75	.84	.95	1.05	1.17	1.28	1.40
8.0	.04	.07	.10	.14	.18	.23	.28	.34	.40	.47	.55	.63	.71	.80	.90	.99	1.10	1.21	1.32
8.5	.04	.06	.09	.13	.16	.21	.26	.31	.38	.44	.51	.59	.67	.75	.84	.93	1.03	1.13	1.24
9.0	.04	.06	.09	.12	.16	.20	.25	.30	.36	.42	.48	.55	.63	.71	.80	.88	.98	1.07	1.17
9.5	.04	.06	.08	.11	.15	.19	.23	.28	.34	.40	.46	.53	.60	.67	.75	.84	.93	1.02	1.11
10.0	.04	.05	.08	.10	.14	.19	.23	.27	.31	.37	.44	.50	.57	.64	.71	.79	.84	.90	1.09

v	2.3	2.4	2.5	2.6	2.7	2.8	2.9	3.0	3.1	3.2	3.3	3.4	3.5	3.6	3.7	3.8	3.9	4.0
h	0.0822	0.0895	0.0972	0.1051	0.1133	0.1219	0.1307	0.1399	0.1494	0.1592	0.1693	0.1797	0.1904	0.2015	0.2128	0.2128	0.2365	0.2487
$h^{\frac{3}{2}}$	0.0235	0.0268	0.0303	0.0340	0.0381	0.0426	0.0472	0.0524	0.0576	0.0634	0.0696	0.0761	0.0830	0.0904	0.0982	0.1064	0.1150	0.1242
D	Percentage increase in discharge $=100\left[1-\frac{H^{\frac{3}{2}}}{D^{\frac{3}{2}}}\right]$																	
0.2	42.03	44.91	48.00	51.14	54.22	57.34	60.64	63.68	67.34	70.65	73.96	75.58	80.80	84.28	87.66	90.35	93.94	97.27
.4	23.06	24.77	26.59	28.45	30.29	32.19	34.15	36.09	38.15	40.22	42.27	44.37	46.50	48.66	50.79	53.07	55.26	57.39
.6	16.12	17.64	18.68	20.02	37.16	22.80	24.17	25.60	27.12	28.62	30.14	31.75	33.26	34.87	36.47	38.12	39.86	41.49
.8	12.44	13.42	14.46	15.51	16.58	17.77	18.89	19.95	21.16	22.26	23.56	24.80	26.06	27.36	28.64	29.97	31.28	32.73
1.0	10.23	11.04	11.90	12.77	13.66	14.57	15.51	16.46	17.47	18.47	19.48	20.52	21.58	22.66	23.74	24.86	26.00	27.11
1.5	7.06	7.65	8.28	8.84	9.47	10.03	10.78	11.46	12.12	12.88	13.62	14.36	15.12	15.90	16.67	17.48	18.30	18.84
2.0	5.44	5.85	6.32	6.79	7.28	7.78	8.30	8.83	9.39	9.93	10.51	11.10	11.69	12.27	12.92	13.55	14.18	14.83
2.5	4.36	4.73	5.11	5.50	5.90	6.32	6.74	7.17	7.63	8.09	8.56	9.04	9.53	10.04	10.54	11.07	11.60	12.14
3.0	3.68	3.99	4.31	4.64	4.98	5.33	5.70	6.07	6.45	6.84	7.24	7.78	8.00	8.50	8.93	9.38	9.84	10.29
3.5	3.18	3.44	3.73	4.01	4.31	4.61	4.93	5.25	6.04	5.93	6.27	6.63	7.00	7.37	7.75	8.14	8.54	8.86
4.0	2.80	3.04	3.28	3.54	3.80	4.07	4.35	4.63	4.93	5.23	5.54	5.86	6.24	6.52	6.85	7.20	7.56	7.91
4.5	2.50	2.71	2.93	3.16	3.40	3.64	3.89	4.14	4.41	4.68	4.96	5.24	5.5	5.84	6.14	6.45	6.7	7.11
5.0	2.26	2.46	2.66	2.87	3.09	3.30	3.53	3.76	4.00	4.25	4.50	4.75	5.0	5.30	5.57	5.86	6.15	6.44
5.5	2.10	2.24	2.42	2.61	2.80	3.01	3.21	3.43	3.63	3.88	4.11	4.34	4.59	4.84	5.09	5.35	5.63	5.88
6.0	1.90	2.06	2.22	2.40	2.58	2.77	2.96	3.09	3.36	3.57	3.78	4.00	4.2	4.46	4.69	4.93	5.1	5.40
6.5	1.75	1.90	2.06	2.22	2.39	2.56	2.74	2.94	3.17	3.31	3.57	3.71	3.9	4.13	4.35	4.52	4.8	5.01
7.0	1.63	1.78	1.92	2.07	2.23	2.39	2.55	2.67	2.96	3.09	3.27	3.46	3.6	3.86	4.06	4.15	4.4	4.68
7.5	1.53	1.66	1.80	1.94	2.13	2.22	2.39	2.55	2.73	2.88	3.06	3.24	3.4	3.61	3.80	4.00	4.2	4.41
8.0	1.44	1.56	1.69	1.82	1.96	2.10	2.25	2.40	2.56	2.72	2.88	3.04	3.2	3.40	3.58	3.76	3.9	4.13
8.5	1.35	1.47	1.59	1.72	1.85	1.98	2.12	2.26	2.41	2.56	2.72	2.88	3.0	3.20	3.38	3.55	3.7	3.89
9.0	1.28	1.39	1.51	1.62	1.78	1.87	2.0	2.14	2.28	2.43	2.57	2.72	2.9	3.04	3.20	3.36	3.5	3.69
9.5	1.22	1.32	1.43	1.54	1.66	1.78	1.90	2.03	2.17	2.30	2.44	2.59	2.7	2.88	3.04	3.20	3.3	3.51
10.0	1.15	1.25	1.36	1.47	1.57	1.68	1.80	1.94	2.05	2.19	2.32	2.47	2.6	2.74	2.89	3.04	3.2	3.36

To use this table the discharge corresponding to the measured head D may be taken directly from Table 3 or 4 and the quantity so obtained increased by the percentage indicated in Table 2. This table is especially useful where the velocity of approach is measured directly. If the velocity of approach is determined from the approximate discharge by the formula $v=\frac{Q}{A}$, successive approximate corrections may be required.

Table 2 shows directly the relative error introduced by various velocities of approach. The large error introduced by moderate velocities with low heads and the comparatively small error resulting from higher velocities under great heads are conspicuous.

TABLES 3 AND 4.—DISCHARGE OVER A THIN-EDGED WEIR BY THE FRANCIS FORMULA.

These tables give the discharge in cubic feet per second, for a crest length of 1 foot, without contractions, computed by the formula

$$Q=3.33LH^{\frac{3}{2}}.$$

TABLE 3.—*Discharge over a thin-edged weir per foot of crest.*

Head H, feet.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
0.00	0.0000	0.0001	0.0003	0.0005	0.0008	0.0012	0.0015	0.0020	0.0024	0.0028
.01	.0033	.0038	.0044	.0049	.0055	.0061	.0067	.0074	.0080	.0087
.02	.0094	.0101	.0109	.0116	.0124	.0132	.0140	.0148	.0156	.0164
.03	.0173	.0182	.0191	.0200	.0209	.0218	.0227	.0237	.0247	.0256
.04	.0266	.0276	.0287	.0297	.0307	.0318	.0329	.0339	.0350	.0361
.05	.0372	.0384	.0395	.0406	.0418	.0430	.0441	.0453	.0465	.0477
.06	.0489	.0502	.0514	.0527	.0539	.0552	.0565	.0578	.0590	.0604
.07	.0617	.0630	.0643	.0657	.0670	.0684	.0698	.0712	.0725	.0739
.08	.0753	.0768	.0782	.0796	.0811	.0825	.0840	.0855	.0869	.0884
.09	.0899	.0914	.0929	.0944	.0960	.0975	.0990	.1006	.1022	.1037
0.10	0.1053	0.1069	0.1085	0.1101	0.1117	0.1133	0.1149	0.1166	0.1182	0.1198
.11	.1215	.1231	.1248	.1265	.1282	.1299	.1316	.1333	.1350	.1367
.12	.1384	.1402	.1419	.1436	.1454	.1472	.1489	.1507	.1525	.1543
.13	.1561	.1579	.1597	.1615	.1633	.1652	.1670	.1689	.1707	.1726
.14	.1744	.1763	.1782	.1801	.1820	.1839	.1858	.1877	.1896	.1915
.15	.1935	.1954	.1973	.1993	.2012	.2032	.2052	.2072	.2091	.2111
.16	.2131	.2151	.2171	.2191	.2212	.2232	.2252	.2273	.2293	.2314
.17	.2334	.2355	.2375	.2396	.2417	.2438	.2459	.2480	.2501	.2522
.18	.2543	.2564	.2586	.2607	.2628	.2650	.2671	.2693	.2714	.2736
.19	.2758	.2780	.2802	.2823	.2845	.2867	.2890	.2912	.2934	.2956
0.20	0.2978	0.3001	0.3023	0.3046	0.3068	0.3091	0.3113	0.3136	0.3159	0.3182
.21	.3205	.3228	.3250	.3274	.3297	.3320	.3343	.3366	.3389	.3413
.22	.3436	.3460	.3483	.3507	.3530	.3554	.3578	.3601	.3625	.3649
.23	.3673	.3697	.3721	.3745	.3769	.3794	.3818	.3842	.3866	.3891
.24	.3915	.3940	.3964	.3989	.4014	.4038	.4063	.4088	.4113	.4138
.25	.4162	.4187	.4213	.4238	.4263	.4288	.4313	.4339	.4364	.4389
.26	.4415	.4440	.4466	.4491	.4517	.4543	.4568	.4594	.4620	.4646
.27	.4672	.4698	.4724	.4750	.4776	.4802	.4828	.4855	.4881	.4907
.28	.4934	.4960	.4987	.5013	.5040	.5067	.5093	.5120	.5147	.5174
.29	.5200	.5227	.5254	.5281	.5308	.5336	.5363	.5390	.5417	.5444

TABLE 3.—*Discharge over a thin-edged weir per foot of crest*—Continued.

Head *H*, feet.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
0.30	0.5472	0.5499	0.5527	0.5554	0.5582	0.5609	0.5637	0.5664	0.5692	0.5720
.31	.5748	.5775	.5803	.5831	.5859	.5887	.5915	.5943	.5972	.6000
.32	.6028	.6056	.6085	.6113	.6141	.6170	.6198	.6227	.6255	.6284
.33	.6313	.6341	.6370	.6399	.6428	.6457	.6486	.6515	.6544	.6573
.34	.6602	.6631	.6660	.6689	.6719	.6748	.6777	.6807	.6836	.6866
.35	.6895	.6925	.6954	.6984	.7014	.7043	.7073	.7103	.7133	.7163
.36	.7193	.7223	.7253	.7283	.7313	.7343	.7373	.7404	.7434	.7464
.37	.7495	.7525	.7555	.7586	.7616	.7647	.7678	.7708	.7739	.7770
.38	.7800	.7831	.7862	.7893	.7924	.7955	.7986	.8017	.8048	.8079
.39	.8110	.8142	.8173	.8204	.8235	.8267	.8298	.8330	.8361	.8393
0.40	0.8424	0.8456	0.8488	0.8519	0.8551	0.8583	0.8615	0.8646	0.8678	0.8710
.41	.8742	.8774	.8806	.8838	.8870	.8903	.8935	.8967	.8999	.9032
.42	.9064	.9096	.9129	.9161	.9194	.9226	.9259	.9292	.9324	.9357
.43	.9390	.9422	.9455	.9488	.9521	.9554	.9587	.9620	.9653	.9686
.44	.9719	.9752	.9785	.9819	.9852	.9885	.9919	.9952	.9985	1.0019
.45	1.0052	1.0086	1.0119	1.0153	1.0187	1.0220	1.0254	1.0288	1.0321	1.0355
.46	1.0389	1.0423	1.0457	1.0491	1.0525	1.0559	1.0593	1.0627	1.0661	1.0696
.47	1.0730	1.0761	1.0798	1.0833	1.0867	1.0901	1.0936	1.0970	1.1005	1.1039
.48	1.1074	1.1109	1.1143	1.1178	1.1213	1.1248	1.1282	1.1317	1.1352	1.1387
.49	1.1422	1.1457	1.1492	1.1527	1.1562	1.1597	1.1632	1.1668	1.1703	1.1738
0.50	1.1773	1.1809	1.1844	1.1879	1.1915	1.1950	1.1986	1.2021	1.2057	1.2093
.51	1.2128	1.2164	1.2200	1.2235	1.2271	1.2307	1.2343	1.2379	1.2415	1.2451
.52	1.2487	1.2523	1.2559	1.2595	1.2631	1.2667	1.2703	1.2740	1.2776	1.2812
.53	1.2849	1.2885	1.2921	1.2958	1.2994	1.3031	1.3067	1.3104	1.3141	1.3177
.54	1.3214	1.3251	1.3287	1.3324	1.3361	1.3398	1.3435	1.3472	1.3509	1.3546
.55	1.3583	1.3620	1.3657	1.3694	1.3731	1.3768	1.3806	1.3843	1.3880	1.3918
.56	1.3955	1.3992	1.4030	1.4067	1.4105	1.4142	1.4180	1.4217	1.4255	1.4293
.57	1.4330	1.4368	1.4406	1.4444	1.4481	1.4519	1.4557	1.4595	1.4633	1.4671
.58	1.4709	1.4747	1.4785	1.4823	1.4862	1.4900	1.4938	1.4976	1.5014	1.5053
.59	1.5091	1.5130	1.5168	1.5206	1.5245	1.5283	1.5322	1.5361	1.5399	1.5438
0.60	1.5476	1.5515	1.5554	1.5593	1.5631	1.5670	1.5709	1.5748	1.5787	1.5826
.61	1.5865	1.5904	1.5943	1.5982	1.6021	1.6060	1.6100	1.6139	1.6178	1.6217
.62	1.6257	1.6296	1.6335	1.6375	1.6414	1.6454	1.6493	1.6533	1.6572	1.6612
.63	1.6652	1.6691	1.6731	1.6771	1.6810	1.6850	1.6890	1.6930	1.6970	1.7010
.64	1.7050	1.7090	1.7130	1.7170	1.7210	1.7250	1.7290	1.7330	1.7370	1.7410
.65	1.7451	1.7491	1.7531	1.7572	1.7612	1.7652	1.7693	1.7733	1.7774	1.7814
.66	1.7855	1.7896	1.7936	1.7977	1.8018	1.8058	1.8099	1.8140	1.8181	1.8221
.67	1.8262	1.8303	1.8344	1.8385	1.8426	1.8467	1.8508	1.8549	1.8590	1.8632
.68	1.8673	1.8714	1.8755	1.8796	1.8838	1.8879	1.8920	1.8962	1.9003	1.9045
.69	1.9086	1.9128	1.9169	1.9211	1.9252	1.9294	1.9336	1.9377	1.9419	1.9461
0.70	1.9503	1.9544	1.9586	1.9628	1.9670	1.9712	1.9754	1.9796	1.9838	1.9880
.71	1.9922	1.9964	2.0006	2.0048	2.0091	2.0133	2.0175	2.0217	2.0260	2.0302
.72	2.0344	2.0387	2.0429	2.0472	2.0514	2.0557	2.0599	2.0642	2.0684	2.0727
.73	2.0770	2.0812	2.0855	2.0898	2.0941	2.0983	2.1026	2.1069	2.1112	2.1155
.74	2.1198	2.1241	2.1284	2.1327	2.1370	2.1413	2.1456	2.1499	2.1543	2.1586
.75	2.1629	2.1672	2.1716	2.1759	2.1802	2.1846	2.1889	2.1932	2.1976	2.2019
.76	2.2063	2.2107	2.2150	2.2194	2.2237	2.2281	2.2325	2.2369	2.2412	2.2456
.77	2.2500	2.2544	2.2588	2.2632	2.2675	2.2719	2.2763	2.2807	2.2851	2.2896
.78	2.2940	2.2984	2.3028	2.3072	2.3116	2.3161	2.3205	2.3249	2.3293	2.3338
.79	2.3382	2.3427	2.3471	2.3515	2.3560	2.3604	2.3649	2.3694	2.3738	2.3783

TABLE 3.—*Discharge over a thin-edged weir per foot of crest*—Continued.

Head *H*, feet.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
0.80	2.3828	2.3872	2.3917	2.3962	2.4006	2.4051	2.4096	2.4141	2.4186	2.4231
.81	2.4276	2.4321	2.4366	2.4411	2.4456	2.4501	2.4546	2.4591	2.4636	2.4681
.82	2.4727	2.4772	2.4817	2.4862	2.4908	2.4953	2.4999	2.5044	2.5089	2.5135
.83	2.5180	2.5226	2.5271	2.5317	2.5363	2.5408	2.5454	2.5500	2.5545	2.5591
.84	2.5637	2.5683	2.5728	2.5774	2.5820	2.5866	2.5912	2.5958	2.6004	2.6050
.85	2.6096	2.6142	2.6188	2.6234	2.6280	2.6327	2.6373	2.6419	2.6465	2.6511
.86	2.6558	2.6604	2.6650	2.6697	2.6743	2.6790	2.6836	2.6883	2.6929	2.6976
.87	2.7022	2.7069	2.7116	2.7162	2.7209	2.7256	2.7302	2.7349	2.7396	2.7443
.88	2.7490	2.7536	2.7583	2.7630	2.7677	2.7724	2.7771	2.7818	2.7865	2.7912
.89	2.7959	2.8007	2.8054	2.8101	2.8148	2.8195	2.8243	2.8290	2.8337	2.8385
0.90	2.8432	2.8479	2.8527	2.8574	2.8622	2.8669	2.8717	2.8764	2.8812	2.8860
.91	2.8907	2.8955	2.9003	2.9050	2.9098	2.9146	2.9194	2.9241	2.9289	2.9337
.92	2.9385	2.9433	2.9481	2.9529	2.9577	2.9625	2.9673	2.9721	2.9769	2.9817
.93	2.9865	2.9914	2.9962	3.0010	3.0058	3.0107	3.0155	3.0203	3.0252	3.0300
.94	3.0348	3.0397	3.0445	3.0494	3.0542	3.0591	3.0639	3.0688	3.0737	3.0785
.95	3.0834	3.0883	3.0931	3.0980	3.1029	3.1078	3.1127	3.1175	3.1224	3.1273
.96	3.1322	3.1371	3.1420	3.1469	3.1518	3.1567	3.1616	3.1665	3.1714	3.1764
.97	3.1813	3.1862	3.1911	3.1960	3.2010	3.2059	3.2108	3.2158	3.2207	3.2257
.98	3.2306	3.2355	3.2405	3.2454	3.2504	3.2554	3.2603	3.2653	3.2702	3.2752
.99	3.2802	3.2851	3.2901	3.2951	3.3001	3.3051	3.3100	3.3150	3.3200	3.3250
1.00	3.3300	3.3350	3.3400	3.3450	3.3500	3.3550	3.3600	3.3650	3.3700	3.3751
.01	3.3801	3.3851	3.3901	3.3951	3.4002	3.4052	3.4102	3.4153	3.4203	3.4254
.02	3.4304	3.4354	3.4405	3.4455	3.4506	3.4557	3.4607	3.4658	3.4708	3.4759
.03	3.4810	3.4860	3.4911	3.4962	3.5013	3.5063	3.5114	3.5165	3.5216	3.5267
.04	3.5318	3.5369	3.5420	3.5471	3.5522	3.5573	3.5624	3.5675	3.5726	3.5777
.05	3.5828	3.5880	3.5931	3.5982	3.6033	3.6085	3.6136	3.6187	3.6239	3.6290
.06	3.6342	3.6393	3.6444	3.6496	3.6547	3.6599	3.6651	3.6702	3.6754	3.6805
.07	3.6857	3.6909	3.6960	3.7012	3.7064	3.7116	3.7167	3.7219	3.7271	3.7323
.08	3.7375	3.7427	3.7479	3.7531	3.7583	3.7635	3.7687	3.7739	3.7791	3.7843
.09	3.7895	3.7947	3.8000	3.8052	3.8104	3.8156	3.8209	3.8261	3.8313	3.8365
1.10	3.8418	3.8470	3.8523	3.8575	3.8628	3.8680	3.8733	3.8785	3.8838	3.8890
.11	3.8943	3.8996	3.9048	3.9101	3.9154	3.9206	3.9259	3.9312	3.9365	3.9418
.12	3.9470	3.9523	3.9576	3.9629	3.9682	3.9735	3.9788	3.9841	3.9894	3.9947
.13	4.0000	4.0053	4.0106	4.0160	4.0213	4.0266	4.0319	4.0372	4.0426	4.0479
.14	4.0532	4.0586	4.0639	4.0692	4.0746	4.0799	4.0853	4.0906	4.0960	4.1013
.15	4.1067	4.1120	4.1174	4.1228	4.1281	4.1335	4.1389	4.1442	4.1496	4.1550
.16	4.1604	4.1657	4.1711	4.1765	4.1819	4.1873	4.1927	4.1981	4.2035	4.2089
.17	4.2143	4.2197	4.2251	4.2305	4.2359	4.2413	4.2467	4.2522	4.2576	4.2630
.18	4.2684	4.2738	4.2793	4.2847	4.2901	4.2956	4.3010	4.3065	4.3119	4.3173
.19	4.3228	4.3282	4.3337	4.3392	4.3446	4.3501	4.3555	4.3610	4.3665	4.3719
1.20	4.3774	4.3829	4.3883	4.3938	4.3993	4.4048	4.4103	4.4158	4.4212	4.4267
.21	4.4322	4.4377	4.4432	4.4487	4.4542	4.4597	4.4652	4.4707	4.4763	4.4818
.22	4.4873	4.4928	4.4983	4.5038	4.5094	4.5149	4.5204	4.5260	4.5315	4.5370
.23	4.5426	4.5481	4.5537	4.5592	4.5647	4.5703	4.5759	4.5814	4.5870	4.5925
.24	4.5981	4.6036	4.6092	4.6148	4.6203	4.6259	4.6315	4.6371	4.6427	4.6482
.25	4.6538	4.6594	4.6650	4.6706	4.6762	4.6818	4.6874	4.6930	4.6986	4.7042
.26	4.7098	4.7154	4.7210	4.7266	4.7322	4.7378	4.7435	4.7491	4.7547	4.7603
.27	4.7660	4.7716	4.7772	4.7829	4.7885	4.7941	4.7998	4.8054	4.8111	4.8167
.28	4.8224	4.8280	4.8337	4.8393	4.8450	4.8506	4.8563	4.8620	4.8676	4.8733
.29	4.8790	4.8847	4.8903	4.8960	4.9017	4.9074	4.9131	4.9187	4.9244	4.9301

TABLE 3.—*Discharge over a thin-edged weir per foot of crest*—Continued.

Head *H*, feet.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
1.30	4.9858	4.9415	4.9472	4.9529	4.9586	4.9643	4.9700	4.9757	4.9814	4.9872
.31	4.9929	4.9986	5.0043	5.0100	5.0158	5.0215	5.0272	5.0330	5.0387	5.0444
.32	5.0502	5.0559	5.0616	5.0674	5.0731	5.0789	5.0846	5.0904	5.0961	5.1019
.33	5.1077	5.1134	5.1192	5.1249	5.1307	5.1365	5.1423	5.1480	5.1538	5.1596
.34	5.1654	5.1712	5.1769	5.1827	5.1885	5.1943	5.2001	5.0259	5.2117	5.2175
.35	5.2233	5.2291	5.2349	5.2407	5.2465	5.2523	5.2582	5.2640	5.2698	5.2756
.36	5.2814	5.2873	5.2931	5.2989	5.3048	5.3106	5.3164	5.3223	5.3281	5.3340
.37	5.3398	5.3456	5.3515	5.3573	5.3632	5.3691	5.3749	5.3808	5.3866	5.3925
.38	5.3984	5.4142	5.4101	5.4160	5.4219	5.4277	5.4336	5.4395	5.4454	5.4513
.39	5.4572	5.4630	5.4689	5.4748	5.4807	5.4866	5.4925	5.4984	5.5043	5.5102
1.40	5.5162	5.5221	5.5280	5.5339	5.5398	5.5457	5.5516	5.5576	5.5635	5.5694
.41	5.5754	5.5813	5.5872	5.5932	5.5991	5.6050	5.6110	5.6169	5.6229	5.6288
.42	5.6348	5.6407	5.6467	5.6526	5.6586	5.6646	5.6705	5.6765	5.6825	5.6884
.43	5.6944	5.7004	5.7064	5.7123	5.7183	5.7243	5.7303	5.7363	5.7423	5.7482
.44	5.7542	5.7602	5.7662	5.7722	5.7782	5.7842	5.7902	5.7962	5.8023	5.8083
.45	5.8143	5.8203	5.8263	5.8323	5.8384	5.8444	5.8504	5.8564	5.8625	5.8685
.46	5.8745	5.8806	5.8866	5.8926	5.8987	5.9047	5.9108	5.9168	5.9229	5.9289
.47	5.9350	5.9410	5.9471	5.9532	5.9592	5.9653	5.9714	5.9774	5.9835	5.9896
.48	5.9957	6.0017	6.0078	6.0139	6.0200	6.0261	6.0322	6.0382	6.0443	6.0504
.49	6.0565	6.0626	6.0687	6.0748	6.0809	6.0870	6.0931	6.0993	6.1054	6.1115
1.50	6.1176	6.1237	6.1298	6.1360	6.1421	6.1482	6.1543	6.1605	6.1666	6.1727
.51	6.1789	6.1850	6.1912	6.1973	6.2034	6.2096	6.2157	6.2219	6.2280	6.2342
.52	6.2404	6.2465	6.2527	6.2588	6.2650	6.2712	6.2773	6.2835	6.2897	6.2959
.53	6.3020	6.3082	6.3144	6.3206	6.3268	6.3330	6.3391	6.3453	6.3515	6.3577
.54	6.3639	6.3701	6.3763	6.3825	6.3887	6.3949	6.4012	6.4074	6.4136	6.4198
.55	6.4260	6.4322	6.4385	6.4447	6.4509	6.4571	6.4634	6.4696	6.4758	6.4821
.56	6.4883	6.4945	6.5008	6.5070	6.5133	6.5195	6.5258	6.5320	6.5383	6.5445
.57	6.5508	6.5570	6.5633	6.5696	6.5758	6.5821	6.5884	6.5946	6.6009	6.6072
.58	6.6135	6.6198	6.6260	6.6323	6.6386	6.6449	6.6512	6.6575	6.6638	6.6701
.59	6.6764	6.6827	6.6890	6.6953	6.7016	6.7079	6.7142	6.7205	6.7268	6.7331
1.60	6.7394	6.7458	6.7521	6.7584	6.7647	6.7711	6.7774	6.7837	6.7901	6.7964
.61	6.8027	6.8091	6.8154	6.8217	6.8281	6.8344	6.8408	6.8471	6.8535	6.8598
.62	6.8662	6.8726	6.8789	6.8853	6.8916	6.8980	6.9044	6.9108	6.9171	6.9235
.63	6.9299	6.9363	6.9426	6.9490	6.9554	6.9618	6.9682	6.9746	6.9810	6.9874
.64	6.9937	7.0001	7.0065	7.0129	7.0193	7.0258	7.0322	7.0386	7.0450	7.0514
.65	7.0578	7.0642	7.0706	7.0771	7.0835	7.0899	7.0963	7.1028	7.1092	7.1156
.66	7.1221	7.1285	7.1349	7.1414	7.1478	7.1543	7.1607	7.1672	7.1736	7.1801
.67	7.1865	7.1930	7.1994	7.2059	7.2124	7.2188	7.2253	7.2318	7.2382	7.2447
.68	7.2512	7.2576	7.2641	7.2706	7.2771	7.2836	7.2901	7.2965	7.3030	7.3095
.69	7.3160	7.3225	7.3290	7.3355	7.3420	7.3485	7.3550	7.3615	7.3680	7.3745
1.70	7.3810	7.3876	7.3941	7.4006	7.4071	7.4136	7.4201	7.4267	7.4332	7.4397
.71	7.4463	7.4528	7.4593	7.4659	7.4724	7.4789	7.4855	7.4920	7.4986	7.5051
.72	7.5117	7.5182	7.5248	7.5313	7.5379	7.5445	7.5510	7.5576	7.5641	7.5707
.73	7.5773	7.5839	7.5904	7.5970	7.6036	7.6102	7.6167	7.6233	7.6299	7.6365
.74	7.6431	7.6497	7.6563	7.6628	7.6694	7.6760	7.6826	7.6892	7.6958	7.7024
.75	7.7091	7.7157	7.7223	7.7289	7.7355	7.7421	7.7487	7.7554	7.7620	7.7686
.76	7.7752	7.7819	7.7885	7.7951	7.8018	7.8084	7.8150	7.8217	7.8283	7.8349
.77	7.8416	7.8482	7.8549	7.8615	7.8682	7.8748	7.8815	7.8882	7.8948	7.9015
.78	7.9081	7.9148	7.9215	7.9281	7.9348	7.9415	7.9482	7.9548	7.9615	7.9682
.79	7.9749	7.9816	7.9882	7.9949	8.0016	8.0083	8.0150	8.0217	8.0284	8.0351

TABLE 3.—*Discharge over a thin-edged weir per foot of crest*—Continued.

Head *H*, feet.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
1.80	8.0418	8.0485	8.0552	8.0619	8.0686	8.0753	8.0820	8.0888	8.0955	8.1022
.81	8.1089	8.1156	8.1223	8.1291	8.1358	8.1425	8.1493	8.1560	8.1627	8.1695
.82	8.1762	8.1829	8.1897	8.1964	8.2032	8.2099	8.2167	8.2234	8.2302	8.2369
.83	8.2437	8.2504	8.2572	8.2640	8.2707	8.2775	8.2842	8.2910	8.2978	8.3046
.84	8.3113	8.3181	8.3249	8.3317	8.3385	8.3452	8.3520	8.3588	8.3656	8.3724
.85	8.3792	8.3860	8.3928	8.3996	8.4064	8.4132	8.4200	8.4268	8.4336	8.4404
.86	8.4472	8.4540	8.4608	8.4677	8.4745	8.4813	8.4881	8.4949	8.5018	8.5086
.87	8.5154	8.5223	8.5291	8.5359	8.5428	8.5496	8.5564	8.5633	8.5701	8.5770
.88	8.5838	8.5907	8.5975	8.6044	8.6112	8.6181	8.6250	8.6318	8.6387	8.6455
.89	8.6524	8.6593	8.6661	8.6730	8.6799	8.6868	8.6936	8.7005	8.7074	8.7143
1.90	8.7212	8.7281	8.7349	8.7418	8.7487	8.7556	8.7625	8.7694	8.7763	8.7832
.91	8.7901	8.7970	8.8039	8.8108	8.8177	8.8246	8.8316	8.8385	8.8454	8.8523
.92	8.8592	8.8662	8.8731	8.8800	8.8869	8.8939	8.9008	8.9077	8.9147	8.9216
.93	8.9285	8.9355	8.9424	8.9494	8.9563	8.9633	8.9702	8.9772	8.9841	8.9911
.94	8.9980	9.0050	9.0119	9.0189	9.0259	9.0328	9.0398	9.0468	9.0537	9.0607
.95	9.0677	9.0747	9.0816	9.0886	9.0956	9.1026	9.1096	9.1165	9.1235	9.1305
.96	9.1375	9.1445	9.1515	9.1585	9.1655	9.1725	9.1795	9.1865	9.1935	9.2005
.97	9.2075	9.2145	9.2216	9.2286	9.2356	9.2426	9.2496	9.2567	9.2637	9.2707
.98	9.2777	9.2848	9.2918	9.2988	9.3059	9.3129	9.3199	9.3270	9.3340	9.3411
.99	9.3481	9.3552	9.3622	9.3693	9.3763	9.3834	9.3904	9.3975	9.4045	9.4116
2.00	9.4187	9.4257	9.4328	9.4399	9.4469	9.4540	9.4611	9.4682	9.4752	9.4823
.01	9.4894	9.4965	9.5036	9.5106	9.5177	9.5248	9.5319	9.5390	9.5461	9.5532
.02	9.5603	9.5674	9.5745	9.5816	9.5887	9.5958	9.6029	9.6100	9.6171	9.6243
.03	9.6314	9.6385	9.6456	9.6527	9.6599	9.6670	9.6741	9.6812	9.6884	9.6955
.04	9.7026	9.7098	9.7169	9.7240	9.7312	9.7383	9.7455	9.7526	9.7598	9.7669
.05	9.7741	9.7812	9.7884	9.7955	9.8027	9.8098	9.8170	9.8242	9.8313	9.8385
.06	9.8457	9.8528	9.8600	9.8672	9.8744	9.8815	9.8887	9.8959	9.9031	9.9103
.07	9.9174	9.9246	9.9318	9.9390	9.9462	9.9534	9.9606	9.9678	9.9750	9.9822
.08	9.9894	9.9966	10.004	10.011	10.018	10.025	10.033	10.040	10.047	10.054
.09	10.062	10.069	10.076	10.083	10.090	10.098	10.105	10.112	10.119	10.127
2.10	10.134	10.141	10.148	10.156	10.163	10.170	10.177	10.185	10.192	10.189
.11	10.206	10.214	10.221	10.228	10.235	10.243	10.250	10.257	10.264	10.272
.12	10.279	10.286	10.293	10.301	10.308	10.315	10.323	10.330	10.337	10.344
.13	10.352	10.359	10.366	10.374	10.381	10.388	10.396	10.403	10.410	10.417
.14	10.425	10.432	10.439	10.447	10.454	10.461	10.469	10.476	10.483	10.491
.15	10.498	10.505	10.513	10.520	10.527	10.535	10.542	10.549	10.557	10.564
.16	10.571	10.579	10.586	10.593	10.601	10.608	10.615	10.623	10.630	10.637
.17	10.645	10.652	10.659	10.667	10.674	10.682	10.689	10.696	10.704	10.711
.18	10.718	10.726	10.733	10.741	10.748	10.755	10.763	10.770	10.777	10.785
.19	10.792	10.800	10.807	10.814	10.822	10.829	10.837	10.844	10.851	10.859
2.20	10.866	10.874	10.881	10.888	10.896	10.903	10.911	10.918	10.926	10.933
.21	10.940	10.948	10.955	10.963	10.970	10.978	10.985	10.992	11.000	11.007
.22	11.015	11.022	11.030	11.037	11.045	11.052	11.059	11.067	11.074	11.082
.23	11.089	11.097	11.104	11.112	11.119	11.127	11.134	11.141	11.149	11.156
.24	11.164	11.171	11.179	11.186	11.194	11.201	11.209	11.216	11.224	11.231
.25	11.239	11.246	11.254	11.261	11.269	11.276	11.284	11.291	11.299	11.306
.26	11.314	11.321	11.329	11.336	11.344	11.351	11.359	11.366	11.374	11.381
.27	11.389	11.396	11.404	11.412	11.419	11.427	11.434	11.442	11.449	11.457
.28	11.464	11.472	11.479	11.487	11.494	11.502	11.510	11.517	11.525	11.532
.29	11.540	11.547	11.555	11.562	11.570	11.578	11.585	11.593	11.600	11.608

TABLE 3.—*Discharge over a thin-edged weir per foot of crest*—Continued.

Head *H*, feet.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
2.30	11.615	11.623	11.631	11.638	11.646	11.653	11.661	11.669	11.676	11.684
.31	11.691	11.699	11.706	11.714	11.722	11.729	11.737	11.744	11.752	11.760
.32	11.767	11.775	11.783	11.790	11.798	11.805	11.813	11.821	11.828	11.836
.33	11.843	11.851	11.859	11.866	11.874	11.882	11.889	11.897	11.904	11.912
.34	11.920	11.927	11.935	11.943	11.950	11.958	11.966	11.973	11.981	11.989
.35	11.996	12.004	12.012	12.019	12.027	12.035	12.042	12.050	12.058	12.065
.36	12.073	12.081	12.088	12.096	12.104	12.111	12.119	12.127	12.134	12.142
.37	12.150	12.157	12.165	12.173	12.181	12.188	12.196	12.204	12.211	12.219
.38	12.227	12.234	12.242	12.250	12.258	12.265	12.273	12.281	12.288	12.296
.39	12.304	12.312	12.319	12.327	12.335	12.342	12.350	12.358	12.366	12.373
2.40	12.381	12.389	12.397	12.404	12.412	12.420	12.428	12.435	12.443	12.451
.41	12.459	12.466	12.474	12.482	12.490	12.497	12.505	12.513	12.521	12.528
.42	12.536	12.544	12.552	12.560	12.567	12.575	12.583	12.591	12.598	12.606
.43	12.614	12.622	12.630	12.637	12.645	12.653	12.661	12.669	12.676	12.684
.44	12.692	12.700	12.708	12.715	12.723	12.731	12.739	12.747	12.754	12.672
.45	12.770	12.778	12.786	12.794	12.801	12.809	12.817	12.825	12.833	12.840
.46	12.848	12.856	12.864	12.872	12.880	12.888	12.895	12.903	12.911	12.919
.47	12.927	12.935	12.942	12.950	12.958	12.966	12.974	12.982	12.990	12.997
.48	13.005	13.013	13.021	13.029	13.037	13.045	13.053	13.060	13.068	13.076
.49	13.084	13.092	13.100	13.108	13.116	13.124	13.131	13.139	13.147	13.155
2.50	13.163	13.171	13.179	13.187	13.195	13.202	13.210	13.218	13.226	13.234
.51	13.242	13.250	13.258	13.266	13.274	13.282	13.290	13.297	13.305	13.313
.52	13.321	13.329	13.337	13.345	13.353	13.361	13.369	13.377	13.385	13.393
.53	13.401	13.409	13.417	13.424	13.432	13.440	13.448	13.456	13.464	13.472
.54	13.480	13.488	13.496	13.504	13.512	13.520	13.528	13.536	13.544	13.552
.55	13.560	13.568	13.576	13.584	13.592	13.600	13.608	13.616	13.624	13.632
.56	13.640	13.648	13.656	13.664	13.672	13.680	13.688	13.696	13.704	13.712
.57	13.720	13.728	13.736	13.744	13.752	13.760	13.768	13.776	13.784	13.792
.58	13.800	13.808	13.816	13.824	13.832	13.840	13.848	13.856	13.864	13.872
.59	13.880	13.888	13.896	13.904	13.912	13.920	13.928	13.936	13.944	13.953
2.60	13.961	13.969	13.977	13.985	13.993	14.001	14.009	14.017	14.025	14.033
.61	14.041	14.049	14.057	14.065	14.074	14.082	14.090	14.098	14.106	14.114
.62	14.122	14.130	14.138	14.146	14.154	14.162	14.171	14.179	14.187	14.195
.63	14.203	14.211	14.219	14.227	14.235	14.243	14.252	14.260	14.268	14.276
.64	14.284	14.292	14.300	14.308	14.316	14.325	14.333	14.341	14.349	14.357
.65	14.356	14.373	14.382	14.390	14.398	14.406	14.414	14.422	14.430	14.438
.66	14.447	14.455	14.463	14.471	14.479	14.487	14.496	14.504	14.512	14.520
.67	14.528	14.536	14.545	14.553	14.561	14.569	14.577	14.585	14.594	14.602
.68	14.610	14.618	14.626	14.634	14.643	14.651	14.659	14.667	14.675	14.684
.69	14.692	14.700	14.708	14.716	14.725	14.733	14.741	14.749	14.757	14.766
2.70	14.774	14.782	14.790	14.798	14.807	14.815	14.823	14.831	14.839	14.848
.71	14.856	14.864	14.872	14.881	14.889	14.897	14.905	14.913	14.922	14.930
.72	14.938	14.946	14.955	14.963	14.971	14.979	14.988	14.996	15.004	15.012
.73	15.021	15.029	15.037	15.045	15.054	15.062	15.070	15.078	15.087	15.095
.74	15.103	15.112	15.120	15.128	15.136	15.145	15.153	15.161	15.169	15.178
.75	15.186	15.194	15.203	15.211	15.219	15.227	15.236	15.244	15.252	15.261
.76	15.269	15.277	15.285	15.294	15.302	15.310	15.319	15.327	15.335	15.344
.77	15.352	15.360	15.369	15.377	15.385	15.394	15.402	15.410	15.419	15.427
.78	15.435	15.443	15.452	15.460	15.468	15.477	15.485	15.494	15.502	15.510
.79	15.519	15.527	15.535	15.544	15.552	15.560	15.569	15.577	15.585	15.594

TABLE 3.—*Discharge over a thin-edged weir per foot of crest*—Continued.

Head *H*, feet.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
2.80	15.602	15.610	15.619	15.627	15.635	15.644	15.652	15.661	15.669	15.677
.81	15.686	15.694	15.702	15.711	15.719	15.728	15.736	15.744	15.753	15.761
.82	15.769	15.778	15.786	15.795	15.803	15.811	15.820	15.828	15.837	15.845
.83	15.853	15.862	15.870	15.879	15.887	15.895	15.904	15.912	15.921	15.929
.84	15.938	15.946	15.954	15.963	15.971	15.980	15.988	15.997	16.005	16.013
.85	16.022	16.030	16.039	16.047	16.056	16.064	16.072	16.081	16.089	16.098
.86	16.106	16.115	16.123	16.132	16.140	16.148	16.157	16.165	16.174	16.182
.87	16.191	16.199	16.208	16.216	16.225	16.233	16.242	16.250	16.258	16.267
.88	16.275	16.284	16.292	16.301	16.309	16.318	16.326	16.335	16.343	16.352
.89	16.360	16.369	16.377	16.386	16.394	16.403	16.411	16.420	16.428	16.437
2.90	16.445	16.454	16.462	16.471	16.479	16.488	16.496	16.505	16.513	16.522
.91	16.530	16.539	16.547	16.556	16.565	16.573	16.582	16.590	16.599	16.607
.92	16.616	16.624	16.633	16.641	16.650	16.658	16.667	16.675	16.684	16.693
.93	16.701	16.710	16.718	16.727	16.735	16.744	16.752	16.761	16.770	16.778
.94	16.787	16.795	16.804	16.812	16.821	16.830	16.838	16.847	16.855	16.864
.95	16.872	16.881	16.890	16.898	16.907	16.915	16.924	16.932	16.941	16.950
.96	16.958	16.967	16.975	16.984	16.993	17.001	17.010	17.018	17.027	17.036
.97	17.044	17.053	17.062	17.070	17.079	17.087	17.096	17.105	17.113	17.122
.98	17.130	17.139	17.148	17.156	17.165	17.174	17.182	17.191	17.199	17.208
.99	17.217	17.225	17.234	17.243	17.251	17.260	17.269	17.277	17.286	17.295
3.00	17.3033	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE 4.—*Discharge over a thin-edged weir per foot of crest.*

Head *H*, feet.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	0.0000	0.0033	0.0094	0.0173	0.0266	0.0372	0.0489	0.0617	0.0753	0.0899
.1	.1053	.1215	.1384	.1561	.1744	.1935	.2131	.2334	.2543	.2758
.2	.2978	.3205	.3436	.3673	.3915	.4162	.4415	.4672	.4934	.5200
.3	.5472	.5748	.6028	.6313	.6602	.6895	.7193	.7495	.7800	.8110
.4	.8424	.8742	.9084	.9390	.9719	1.0052	1.0389	1.0730	1.1074	1.1422
.5	1.1773	1.2128	1.2487	1.2849	1.3214	1.3583	1.3955	1.4330	1.4709	1.5091
.6	1.5476	1.5865	1.6257	1.6652	1.7050	1.7451	1.7855	1.8262	1.8673	1.9086
.7	1.9503	1.9922	2.0344	2.0770	2.1198	2.1629	2.2063	2.2500	2.2940	2.3382
.8	2.3828	2.4276	2.4727	2.5180	2.5637	2.6096	2.6558	2.7022	2.7490	2.7959
.9	2.8432	2.8907	2.9385	2.9865	3.0348	3.0834	3.1322	3.1813	3.2306	3.2802
1.0	3.3300	3.3801	3.4304	3.4810	3.5318	3.5828	3.6342	3.6857	3.7375	3.7895
1.1	3.8418	3.8943	3.9470	4.0000	4.0532	4.1067	4.1604	4.2143	4.2684	4.3228
1.2	4.3774	4.4322	4.4873	4.5426	4.5981	4.6538	4.7098	4.7660	4.8224	4.8790
1.3	4.9358	4.9929	5.0502	5.1077	5.1654	5.2233	5.2814	5.3398	5.3984	5.4572
1.4	5.5162	5.5754	5.6348	5.6944	5.7542	5.8143	5.8745	5.9350	5.9957	6.0565
1.5	6.1176	6.1789	6.2404	6.3020	6.3638	6.4260	6.4883	6.5508	6.6135	6.6764
1.6	6.7394	6.8027	6.8662	6.9299	6.9937	7.0578	7.1221	7.1865	7.2512	7.3160
1.7	7.3810	7.4463	7.5117	7.5773	7.6431	7.7091	7.7752	7.8416	7.9081	7.9749
1.8	8.0418	8.1089	8.1762	8.2437	8.3113	8.3792	8.4472	8.5154	8.5838	8.6524
1.9	8.7212	8.7901	8.8592	8.9285	8.9980	9.0677	9.1375	9.2075	8.2777	9.3481

TABLE 4.—*Discharge over a thin-edged weir per foot of crest*—Continued.

Head *H*, feet.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
2.0	9.4187	9.4894	9.5603	9.6314	9.7026	9.7741	9.8457	9.9174	9.9894	10.0620
2.1	10.1340	10.2060	10.2790	10.3520	10.4250	10.4980	10.5710	10.6450	10.7180	10.7920
2.2	10.8660	10.9400	11.0150	11.0890	11.1640	11.2390	11.3140	11.3890	11.4640	11.5400
2.3	11.6150	11.6910	11.7670	11.8430	11.9200	11.9960	12.0730	12.1500	12.2270	12.3040
2.4	12.3810	12.4590	12.5360	12.6140	12.6920	12.7700	12.8480	12.9270	13.0050	13.0840
2.5	13.1630	13.2480	13.3210	13.4010	13.4800	13.5600	12.6400	13.7200	13.8000	13.8800
2.6	13.9610	14.0410	14.1220	14.2030	14.2840	14.3650	14.4470	14.5280	14.6100	14.6920
2.7	14.7740	14.8560	14.9380	15.0210	15.1030	15.1860	15.2690	15.3520	15.4350	15.5190
2.8	15.6020	15.6860	15.7690	15.8530	15.9380	16.0220	16.1060	16.1910	16.2750	16.3600
2.9	16.4450	16.5300	16.6160	16.7010	16.7870	16.8720	16.9580	17.0440	17.1300	17.2170
3.0	17.3028	17.3899	17.4698	17.5634	17.6503	17.7376	17.8248	17.9124	18.0000	18.0876
3.1	18.1754	18.2634	18.3516	18.4399	18.5285	18.6170	18.7056	18.7945	18.8838	18.9727
3.2	19.0619	19.1515	19.2410	19.3307	19.4206	19.5105	19.6007	19.6910	19.7812	19.8718
3.3	19.9624	20.0533	20.1442	20.2354	20.3267	20.4179	20.5095	20.6011	20.6930	20.7849
3.4	20.8777	20.9690	21.0613	21.1538	21.2464	21.3390	21.4319	21.5248	21.6180	21.7113
3.5	21.8045	21.8980	21.9917	22.0856	22.1795	22.2734	22.3677	22.4618	22.5564	22.6510
3.6	22.7456	22.8405	22.9354	23.0306	23.1259	23.2211	23.3167	23.4122	23.5081	23.6040
3.7	23.6999	23.7962	23.8924	23.9887	24.0852	24.1818	24.2787	24.3756	24.4728	24.5697
3.8	24.6673	24.7645	24.8621	24.9600	25.0576	25.1555	25.2537	25.3520	25.4502	25.5488
3.9	25.6473	25.7459	25.8748	25.9437	26.0429	26.1422	26.2414	26.3410	26.4405	26.5401
4.0	26.6400	26.7399	26.8401	26.9404	27.0406	27.1412	27.2417	27.3423	27.4432	27.5411
4.1	27.6453	27.7466	27.8478	27.9494	28.0509	28.1525	28.2544	28.3563	28.4582	28.5604
4.2	28.6626	28.7652	28.8678	28.9703	29.0732	29.1761	29.2790	29.3823	29.4855	29.5890
4.3	29.6926	29.7962	29.9001	30.0040	30.1079	30.2118	30.3163	30.4205	30.5251	30.6297
4.4	30.7342	30.8391	30.9440	31.0493	31.1545	31.2597	31.3649	31.4705	31.5764	31.6820
4.5	31.7878	31.8941	32.0003	32.1065	32.2128	32.3193	32.4259	32.5324	32.6393	32.7462
4.6	32.8534	32.9607	33.0679	33.1755	33.2830	33.3906	33.4985	33.6064	33.7143	33.8225
4.7	33.9307	34.0373	34.1475	34.2560	34.3646	34.4735	34.5824	34.6913	34.8005	34.9097
4.8	35.0193	35.1288	35.2354	35.3480	35.4578	35.5677	35.6780	35.7882	35.8984	36.0086
4.9	36.1182	36.2297	36.3406	36.4515	36.5624	36.6736	36.7845	36.8961	37.0073	37.1188
5.0	37.2304	37.3423	37.4542	37.5661	37.6783	37.7905	37.9027	38.0153	38.1275	38.2404
5.1	38.3529	38.4658	28.5787	38.6919	38.8052	38.9184	39.0319	39.1455	39.2591	39.3726
5.2	39.4865	39.6004	39.7146	39.8288	39.9430	40.0576	40.1718	40.2867	40.4012	40.5161
5.3	40.6310	40.7462	40.5281	40.9766	41.0919	41.2074	41.3230	41.4386	41.5544	41.6703
5.4	41.7866	41.9024	42.0186	42.1352	42.2517	42.3683	42.4848	42.6017	42.7186	42.8355
5.5	42.9523	43.0700	43.1871	43.3043	43.4219	42.5394	43.6573	43.7752	43.8931	44.0109
5.6	44.1292	44.2474	44.3659	44.4845	44.6030	44.7216	44.8404	44.9593	45.0782	45.1974
5.7	45.3166	45.4359	45.5554	45.6746	45.7945	45.9140	46.0339	46.1538	46.2740	46.3939
5.8	46.5141	46.6347	46.7552	46.8757	46.9963	47.1172	47.2380	47.3589	47.4798	47.6010
5.9	47.7226	47.8438	47.9653	48.0869	48.2084	48.3303	48.4522	48.5744	48.6963	48.8185
6.0	48.9407	49.0632	49.1858	49.3083	48.4312	49.5537	49.6766	49.7999	49.9230	50.0462
6.1	50.1694	50.2930	50.4162	50.5401	50.6637	50.7875	50.9114	51.0356	51.1595	51.2837
6.2	51.4082	51.5324	51.6570	51.7818	51.9034	52.0318	52.1531	52.2813	52.4062	52.5314
6.3	52.6570	52.7822	52.9077	53.0336	53.1591	53.2850	53.4109	53.5871	53.6630	53.7892
6.4	53.9157	54.0419	54.1684	54.2950	54.4219	54.5487	54.6756	54.8025	54.9297	55.0569
6.5	55.1832	55.3116	55.4392	55.5667	55.6943	55.8221	55.9500	56.0779	56.2061	56.3343
6.6	56.4625	56.5910	56.7192	56.8478	56.9766	57.1055	57.2340	57.3233	57.4921	57.6213
6.7	57.7505	57.8801	58.0093	58.1388	58.2687	58.3982	58.5281	58.6580	58.7882	58.9180
6.8	59.0482	59.1788	59.3090	59.4428	59.5700	59.7009	59.8314	59.9623	60.0935	60.2244
6.9	60.3556	60.4868	60.6183	60.7499	60.8814	61.0129	61.1445	61.2763	61.4082	61.5404

TABLE 4.—*Discharge over a thin-edged weir per foot of crest*—Continued.

Head *H*, feet.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
7.0	61.6736	61.8048	61.9370	62.0692	62.2017	62.3343	62.4671	62.6000	62.7329	62.8657
7.1	62.9986	63.1318	63.2650	63.3992	63.5317	63.6653	63.7991	63.9327	64.0665	64.2004
7.2	64.3343	64.4685	64.6027	64.7369	64.8711	65.0056	65.1268	65.2750	65.4095	65.5444
7.3	65.6793	65.8145	65.9493	66.0845	66.2197	66.3552	66.4908	66.6263	66.7618	66.8977
7.4	67.0336	67.1694	67.3053	67.4415	67.5777	67.7139	67.8504	67.9869	68.1235	68.2600
7.5	68.3969	68.5337	68.6706	68.8078	68.9447	69.0818	69.2794	69.3566	69.4941	69.6316
7.6	69.7695	69.9070	70.0449	70.1827	70.3209	70.4591	70.5973	70.7355	70.8737	71.0123
7.7	71.1508	71.2896	71.4282	71.5670	71.7059	71.8451	71.9843	72.1235	72.2627	72.4743
7.8	72.5414	72.6809	72.8208	72.9603	73.1002	73.2400	73.3802	73.5201	73.6603	73.8005
7.9	73.9410	74.0815	74.2220	74.3626	74.5031	74.6439	74.7848	74.9260	75.0669	75.2081
8.0	75.3492	75.4908	75.6320	75.7735	75.9150	76.0569	76.1987	76.3406	76.4824	76.6243
8.1	76.7665	76.9087	77.0509	77.1934	77.3360	77.4784	77.6210	77.7638	77.9067	78.0496
8.2	78.1924	78.3356	78.4788	78.6220	78.7655	78.9087	79.0522	79.1957	79.3396	79.4834
8.3	79.6273	79.7711	79.9153	80.0592	80.2034	80.3479	80.4921	80.6866	80.7811	80.9260
8.4	81.0705	81.2154	81.3602	81.5054	81.6503	81.7955	81.9406	82.0862	82.2314	82.3769
8.5	82.5224	82.6682	82.8141	82.9600	83.1058	83.2517	83.3979	83.5440	83.6902	83.8367
8.6	83.9833	84.1298	84.2763	84.4228	84.5697	84.7165	84.8634	85.0106	85.1578	85.3049
8.7	85.4521	85.5996	85.7472	85.8947	85.0455	86.1897	86.3376	86.4854	86.6336	86.7815
8.8	86.9297	87.0778	87.2264	87.3745	87.5231	87.6716	87.8204	87.9689	88.1178	88.2666
8.9	88.4192	88.5647	88.7139	88.8630	89.0126	89.1617	89.3113	89.4608	89.6103	89.7602
9.0	89.9100	90.0599	90.2064	90.3599	90.5101	90.6602	90.4778	90.9609	91.1115	91.2620
9.1	91.4125	91.5633	91.7142	91.8650	92.0159	92.1671	92.3183	92.4694	92.6206	92.7721
9.2	92.9237	93.0782	93.2267	93.3785	93.5304	93.6822	93.8341	93.9863	94.1384	94.2906
9.3	94.4428	94.5950	94.7475	94.9000	95.0529	95.2054	95.3582	95.5111	95.6639	95.8171
9.4	95.9703	96.1234	96.2766	96.4298	96.5833	96.7368	96.8903	97.0442	97.1977	97.3516
9.5	97.5057	97.6596	97.8138	97.9679	98.1021	98.2763	98.4308	98.5853	98.7398	98.8943
9.6	99.0492	99.2040	99.3589	99.5141	99.6689	99.8241	99.9793	100.1344	100.2899	100.4455
9.7	100.6010	100.7565	100.9123	101.0678	101.2237	101.3799	101.5357	101.6919	101.8481	102.0042
9.8	102.1607	102.3169	102.4734	102.6299	102.7868	102.9433	103.1001	103.2570	103.4141	103.5710
9.9	103.7282	103.8853	104.0429	104.2000	104.3575	104.5121	104.6726	104.8304	104.9882	105.1461
10.0	105.3039	105.4618	105.6199	105.7781	105.9363	106.0945	106.2530	106.4115	106.5700	106.7285

When applied to a weir with N end contractions, the measured crest length L' should be reduced by the formula

$$L = L' - 0.1\,NH$$

When applied to a weir having appreciable velocity of approach, the measured head should be corrected by the correction formula of Francis (see p. 15), or by one of the simpler approximate equivalents; or the correction may be applied as a percentage to the discharge, by the use of Table 2.

Table 3, taken from Lowell Hydraulic Experiments, by James B. Francis, gives the discharge for heads from zero to 3 feet, advancing by thousandths.

Table 4 is original and gives the discharge for heads from zero to 10.09 feet, advancing by hundredths.

By increasing the quantities from either table 1 per cent, the discharge by the Cippoletti formula will be obtained,

$$Q=3.36\tfrac{3}{8}\ LH^{\frac{3}{2}}.$$

In calculating discharge by this formula, the head should be corrected for velocity of approach by the formula

$$H=D+1.5h.$$

TABLES 5 AND 6.—THREE-HALVES POWERS.

These tables of three-halves powers (cubes of the square roots) were prepared by the writer to facilitate the calculation of discharge over weirs of various forms, by the use of coefficients taken from the diagrams that accompany this paper and the base formula

$$Q=CLH^{\frac{3}{2}}.$$

TABLE 5.—*Three-halves powers for numbers 0 to 1.49.*

Numbers.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
0.00	0.0000	0.0001	0.0002	0.0003	0.0004	0.0005	0.0006	0.0007	0.0008	0.0009	0.0010
.01	.0010	.00118	.00136	.00154	.00172	.00190	.00208	.00236	.00244	.00262	.0028
.02	.0028	.00304	.00328	.00352	.00376	.00400	.00424	.00448	.00472	.00496	.0052
.03	.0052	.00548	.00576	.00604	.00632	.00660	.00688	.00716	.00744	.00772	.0080
.04	.0080	.00832	.00864	.00896	.00928	.00960	.00992	.01024	.01056	.01088	.0112
.05	.0112	.01155	.01190	.01225	.01260	.01295	.01330	.01365	.01400	.01435	.0147
.06	.0147	.01508	.01546	.01584	.01622	.01660	.01698	.01736	.01774	.01812	.0185
.07	.0185	.01891	.01932	.01973	.02014	.02055	.02096	.02137	.02178	.02219	.0226
.08	.0226	.02304	.02348	.02392	.02436	.02480	.02524	.02568	.02612	.02656	.0270
.09	.0270	.02746	.02792	.02838	.02884	.02930	.02976	.03022	.03068	.03114	.0316
0.10	0.0316	0.03209	0.03258	0.03307	0.03356	0.03405	0.03454	0.03503	00355.2	0.03601	0.0365
.11	.0365	.03701	.03752	.03803	.03854	.03905	.03956	.04007	.04058	.04109	.0416
.12	.0416	.04213	.04266	.04319	.04372	.04425	.04478	.04531	.04584	.04637	.0469
.13	.0469	.04745	.04800	.04855	.04910	.04965	.05020	.05075	.05130	.05185	.0524
.14	.0524	.05297	.05354	.05411	.05468	.05525	.05582	.05639	.05696	.05753	.0581
.15	.0581	.05869	.05928	.05987	.06046	.06105	.06164	.06223	.06282	.06341	.0640
.16	.0640	.06151	.06522	.06583	.06644	.06705	.06766	.06827	.06888	.06949	.0701
.17	.0701	.07073	.07136	.07199	.07262	.07325	.07388	.07451	.07514	.07577	.0764
.18	.0764	.07704	.07768	.07832	.07896	.07960	.08024	.08088	.08152	.08216	.0828
.19	.0828	.08346	.08412	.08478	.08544	.08610	.08676	.08742	.08808	.08874	.0894
0.20	0.0894	0.09008	0.09076	0.09144	0.09212	0.09280	0.09348	0.09416	0.09484	009552	0.0962
.21	.0962	.09690	.09760	.09830	.09900	.09970	.10040	.10110	.1018	.1025	.1032
.22	.1032	.10391	.10462	.10533	.10604	.10675	.10746	.10817	.10888	.10959	.1103
.23	.1103	.11103	.11176	.11249	.11322	.11395	.11468	.11541	.11614	.11687	.1176
.24	.1176	.11834	.11908	.11982	.12506	.12130	.12204	.12278	.12352	.12426	.1250
.25	.1250	.12576	.12652	.12728	.12804	.12880	.12956	.13032	.13108	.13184	.1326
.26	.1326	.13337	.13414	.13491	.13568	.13645	.13722	.13799	.13876	.13953	.1403
.27	.1403	.14109	.14188	.14267	.14346	.14425	.14504	.14583	.14662	.14741	.1482
.28	.1482	.1490	.1498	.1506	.1514	.1522	.1530	.1538	.1546	.1554	.1562
.29	.1562	.15701	.15782	.15863	.15944	.16025	.16106	.16187	.16268	.16349	.1643

TABLE 5.—*Three-halves powers for numbers 0 to 1.49*—Continued.

Numbers.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
0.30	0.1643	0.16513	0.16596	0.16679	0.16762	0.16845	0.16928	0.17011	0.17094	0.17177	0.1726
.31	.1726	.17344	.17428	.17512	.17596	.17680	.17764	.17848	.17932	.18016	.1810
.32	.1810	.18186	.18272	.18358	.18444	.18530	.18616	.18702	.18788	.18874	.1896
.33	.1896	.19047	.19134	.19221	.19308	.19395	.19482	.19569	.19656	.19743	.1983
.34	.1983	.19918	.20006	.20094	.20182	.20270	.20358	.20446	.20534	.20622	.2071
.35	.2071	.20799	.20888	.20977	.21066	.21155	.21244	.21333	.21422	.21511	.2160
.36	.2160	.21691	.21782	.21873	.21964	.22055	.22146	.22237	.22328	.22419	.2251
.37	.2251	.22601	.22692	.22783	.22874	.22965	.23056	.2317	.23238	.23329	.2342
.38	.2342	.23514	.23608	.23702	.23796	.23890	.23984	.24078	.24172	.24266	.2436
.39	.2436	.24454	.24548	.24642	.24736	.24830	.24924	.25018	.25112	.25206	.2530
0.40	0.2530	0.25396	0.25490	0.25585	0.25680	0.25775	0.25870	0.25965	0.26060	0.26155	0.2625
.41	.2625	.26347	.26444	.26541	.26638	.26735	.26832	.26929	.27026	.27123	.2722
.42	.2722	.27318	.27416	.27514	.27612	.27710	.27808	.27906	.28004	.28102	.2820
.43	.2820	.28299	.28397	.28497	.28596	.28695	.28794	.28893	.28992	.29091	.2919
.44	.2919	.2929	.2939	.2949	.2959	.2969	.2979	.2989	.2999	.3009	.3019
.45	.3019	.30291	.30392	.30493	.30594	.30695	.30796	.30897	.30998	.31099	.3120
.46	.3120	.31302	.31404	.31506	.31608	.31710	.31812	.31914	.32016	.32118	.3222
.47	.3222	.32323	.32426	.32529	.32632	.32735	.32838	.32941	.33044	.33147	.3325
.48	.3325	.33355	.33460	.33565	.33670	.33775	.33880	.33985	.34090	.34195	.3430
.49	.3430	.34406	.34512	.34618	.34724	.3483	.34936	.35042	.35148	.35254	.3536
0.50	0.3536	0.35466	0.35572	0.35678	0.35784	0.35890	0.35996	0.36102	0.36208	0.36314	0.3642
.51	.3642	.36528	.36636	.36744	.36852	.36960	.37068	.37176	.37284	.37392	.3750
.52	.3750	.37608	.37716	.37824	.37932	.38040	.38148	.38256	.38364	.38472	.3858
.53	.3858	.38690	.38800	.38910	.39020	.39130	.39240	.39350	.39460	.3957	.3968
.54	.3968	.39791	.39902	.40013	.40124	.40235	.40346	.40457	.40568	.40679	.4079
.55	.4079	.40902	.41014	.41126	.41238	.41350	.41462	.41574	.41686	.41798	.4191
.56	.4191	.42022	.42134	.42246	.42358	.42470	.42582	.42694	.42806	.42918	.4303
.57	.4303	.43144	.43258	.43372	.43486	.43600	.43714	.43828	.43942	.44056	.4417
.58	.4417	.44285	.44400	.44515	.44630	.44745	.44860	.44975	.45090	.45205	.4532
.59	.4532	.45436	.45552	.45668	.45784	.45900	.46016	.46132	.46248	.46364	.4648
0.60	0.4648	0.46596	0.46712	0.46828	0.46944	0.47060	0.47176	0.47292	0.47408	0.47524	0.4764
.61	.4764	.47758	.47876	.47994	.48112	.48230	.48348	.48466	.48584	.48702	.4882
.62	.4882	.48938	.49056	.49174	.49292	.49410	.49528	.49646	.49764	.49882	.5000
.63	.5000	.50120	.50240	.5036	.5048	.5060	.5072	.5084	.5096	.5108	.5120
.64	.5120	.5132	.5144	.5156	.5168	.5180	.5192	.5204	.5216	.5228	.5240
.65	.5240	.52522	.52644	.52766	.52888	.53010	.53132	.53254	.53376	.53498	.5362
.66	.5362	.53742	.53864	.53986	.54108	.54230	.54352	.54474	.54596	.54718	.5484
.67	.5484	.54963	.55086	.55209	.55332	.55455	.55578	.55701	.55824	.55947	.5607
.68	.5607	.56195	.56320	.56445	.56570	.56695	.56820	.56945	.57070	.57195	.5732
.69	.5732	.57445	.5757	.57695	.57820	.57945	.58070	.58195	.58320	.58445	.5857
0.70	0.5857	0.58696	0.58822	0.58948	0.59074	0.59200	0.59326	0.59452	0.59578	0.59704	0.5983
.71	.5983	.59956	.60082	.60208	.60334	.60460	.60586	.60712	.60838	.60964	.6109
.72	.6109	.61218	.61346	.61474	.61602	.61730	.61858	.61986	.62114	.62242	.6237
.73	.6237	.62499	.62628	.62757	.62886	.63015	.63144	.63273	.63402	.63531	.6366
.74	.6366	.63789	.63918	.64047	.64176	.64305	.64434	.64563	.64692	.64821	.6495
.75	.6495	.65081	.65212	.65343	.65474	.65605	.65736	.65867	.65998	.66129	.6626
.76	.6626	.66391	.66522	.66653	.66784	.66915	.67046	.67177	.67308	.67439	.6757
.77	.6757	.67702	.67834	.67966	.68098	.68230	.68362	.68494	.68626	.68758	.6889
.78	.6889	.69023	.69156	.69289	.69422	.69555	.69688	.69821	.69954	.70087	.7022
.79	.7022	.70353	.70486	.70619	.70752	.70885	.71018	.71151	.71284	.71417	.7155

TABLE 5.—*Three-halves powers for numbers 0 to 1.49*—Continued.

Numbers.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
0.80	0.7155	0.71685	0.71820	0.71955	0.72090	0.72225	0.72360	0.72495	0.72630	0.72765	0.7290
.81	.7290	.73035	.7317	.73305	.73440	.73575	.73710	.73845	.73980	.74115	.7425
.82	.7425	.74387	.74524	.74661	.74798	.74935	.75072	.75209	.75346	.75483	.7562
.83	.7562	.75757	.75894	.76031	.76168	.76305	.76443	.76579	.76716	.76853	.7699
.84	.7699	.77128	.77266	.77404	.77542	.77680	.77818	.77956	.78094	.78232	.7837
.85	.7837	.78508	.78646	.78784	.78922	.79060	.99198	.79336	.79474	.79612	.7975
.86	.7975	.79890	.80030	.80170	.8031	.8045	.8059	.8073	.8087	.8101	.8115
.87	.8115	.8129	.8143	.8157	.8171	.8185	.8199	.8213	.8227	.8241	.8255
.88	.8255	.82691	.82832	.82973	.83114	.83255	.83396	.83537	.83678	.83819	.8396
.89	.8396	.84102	.84244	.84386	.84528	.84670	.84812	.84954	.85096	.85238	.8538
0.90	0.8538	0.85523	0.85666	0.85809	0.85952	0.86095	0.86238	0.86381	0.86524	0.86667	0.8681
.91	.8681	.86953	.87096	.87239	.87382	.87525	.87668	.87811	.87954	.88097	.8824
.92	.8824	.88385	.8853	.88675	.88820	.88965	.89110	.89255	.8940	.89545	.8969
.93	.8969	.89835	.89980	.90125	.90270	.90415	.9056	.90705	.9085	.90995	.9114
.94	.9114	.91285	.9143	.91575	.91720	.91865	.92010	.92155	.9230	.92445	.9259
.95	.9259	.92737	.92884	.93081	.93178	.93325	.98472	.93619	.93766	.93913	.9406
.96	.9406	.94207	.94354	.94501	.94648	.94795	.94942	.95089	.95236	.95383	.9553
.97	.9553	.95679	.95828	.95977	.96126	.96275	.96424	.96573	.96722	.96871	.9702
.98	.9702	.97168	.97316	.97464	.97612	.97760	.97908	.98056	.98204	.98352	.9850
.99	.9850	.9865	.9880	.9895	.9910	.9925	.9940	.9955	.9970	.9985	1.0000
1.00	1.0000	1.0015	1.0030	1.0045	1.0060	1.0075	1.0090	1.0105	1.0120	1.0135	1.0150
1.01	1.0150	1.01652	1.01804	1.01956	1.02108	1.02260	1.02412	1.02564	1.02716	1.02868	1.0302
1.02	1.0302	1.03171	1.03322	1.03473	1.03624	1.03775	1.03926	1.04077	1.04282	1.04379	1.0453
1.03	1.0453	1.04683	1.04836	1.04989	1.05142	1.05295	1.05448	1.05601	1.05754	1.05907	1.0606
1.04	1.0606	1.06213	1.06366	1.06519	1.06672	1.06825	1.06978	1.07131	1.07284	1.07437	1.0759
1.05	1.0759	1.07744	1.07898	1.08052	1.08206	1.08360	1.08514	1.08668	1.08822	1.08976	1.0913
1.06	1.0913	1.09285	1.09440	1.09595	1.09750	1.09905	1.10060	1.10215	1.10370	1.10525	1.1068
1.07	1.1068	1.10836	1.10992	1.11148	1.11304	1.11460	1.11616	1.11772	1.11928	1.12084	1.1224
1.08	1.1224	1.12396	1.12552	1.12708	1.12864	1.13020	1.13176	1.13332	1.13488	1.13644	1.1380
1.09	1.1380	1.13957	1.14114	1.14271	1.14428	1.14585	1.14742	1.14899	1.15056	1.15213	1.1537
1.10	1.1537	1.15528	1.15686	1.15844	1.16002	1.16160	1.16318	1.16476	1.16634	1.16792	1.1695
1.11	1.1695	1.17108	1.17266	1.17424	1.17582	1.17740	1.17898	1.18056	1.18214	1.18372	1.1853
1.12	1.1853	1.18689	1.18848	1.19007	1.19166	1.19325	1.19484	1.19643	1.19802	1.19961	1.2012
1.13	1.2012	1.20280	1.20440	1.20600	1.20760	1.20920	1.21080	1.21240	1.21400	1.21560	1.2172
1.14	1.2172	1.21880	1.22040	1.22200	1.22360	1.22520	1.22680	1.22840	1.23000	1.23160	1.2332
1.15	1.2332	1.23482	1.23644	1.23806	1.23968	1.24130	1.24292	1.24454	1.24616	1.24778	1.2494
1.16	1.2494	1.25102	1.25264	1.25426	1.25588	1.25750	1.25912	1.26074	1.26236	1.26398	1.2656
1.17	1.2656	1.26722	1.26884	1.27046	1.27208	1.27370	1.27532	1.27694	1.27856	1.28018	1.2818
1.18	1.2818	1.28343	1.28506	1.28669	1.28832	1.28995	1.29158	1.29321	1.29484	1.29647	1.2981
1.19	1.2981	1.29974	1.30138	1.30302	1.30466	1.30630	1.30794	1.30958	1.31122	1.31286	1.3145
1.20	1.3145	1.31615	1.31780	1.31945	1.32110	1.32275	1.32440	1.32605	1.32770	1.32935	1.3310
1.21	1.3310	1.33265	1.33430	1.33595	1.33760	1.33925	1.34090	1.34255	1.34420	1.34585	1.3475
1.22	1.3475	1.34916	1.35082	1.35248	1.35414	1.35580	1.35746	1.35912	1.36078	1.36244	1.3641
1.23	1.3641	1.36577	1.36744	1.36911	1.37078	1.37245	1.37412	1.37579	1.37746	1.37913	1.3808
1.24	1.3808	1.38247	1.38414	1.38581	1.38748	1.38915	1.39082	1.39249	1.39416	1.39583	1.3975
1.25	1.3975	1.39919	1.40088	1.40257	1.40426	1.40595	1.40764	1.40933	1.41102	1.41271	1.4144
1.26	1.4144	1.41608	1.41776	1.41944	1.42112	1.42280	1.42448	1.42616	1.42784	1.42952	1.4312
1.27	1.4312	1.4329	1.4346	1.4363	1.4380	1.4397	1.4414	1.4431	1.4448	1.4465	1.4482
1.28	1.4482	1.4499	1.4516	1.4533	1.4550	1.4567	1.4584	1.4601	1.4618	1.4635	1.4652
1.29	1.4652	1.4669	1.4686	1.4703	1.4720	1.4737	1.4754	1.4771	1.4788	1.4805	1.4822

TABLE 5.—*Three-halves powers for numbers 0 to 1.49*—Continued.

Numbers.	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009	.010
1.30	1.4822	1.48392	1.48564	1.48736	1.48908	1.49080	1.49252	1.49424	1.49596	1.49768	1.4994
1.31	1.4994	1.50112	1.50284	1.50456	1.50628	1.50800	1.50972	1.51144	1.51316	1.51488	1.5166
1.32	1.5166	1.51832	1.52004	1.52176	1.52348	1.52520	1.52692	1.52864	1.53036	1.53208	1.5338
1.33	1.5338	1.53554	1.53728	1.53902	1.54076	1.54250	1.54424	1.54598	1.54772	1.54946	1.5512
1.34	1.5512	1.55294	1.55468	1.55642	1.55816	1.55990	1.56164	1.56338	1.56512	1.56686	1.5686
1.35	1.5686	1.57034	1.57208	1.57382	1.57556	1.57730	1.57904	1.58078	1.58252	1.58426	1.5860
1.36	1.5860	1.58775	1.58950	1.59125	1.59300	1.59475	1.59650	1.59825	1.60000	1.60175	1.6035
1.37	1.6035	1.60526	1.60702	1.60878	1.61054	1.61230	1.61406	1.61582	1.61758	1.61934	1.6211
1.38	1.6211	1.62287	1.62464	1.62641	1.62818	1.62995	1.63172	1.63349	1.63526	1.63703	1.6388
1.39	1.6388	1.64057	1.64234	1.64411	1.64588	1.64765	1.64942	1.65119	1.65296	1.65473	1.6565
1.40	1.6565	1.65828	1.66006	1.66184	1.66362	1.66540	1.66718	1.66896	1.67075	1.67252	1.6743
1.41	1.6743	1.67608	1.67786	1.67964	1.68142	1.68320	1.68498	1.68676	1.68854	1.69032	1.6921
1.42	1.6921	1.69389	1.69568	1.69747	1.69926	1.70105	1.70284	1.70463	1.70642	1.70821	1.7100
1.43	1.7100	1.7118	1.7136	1.7154	1.7172	1.7190	1.7208	1.7226	1.7244	1.7262	1.7280
1.44	1.7280	1.7298	1.7316	1.7334	1.7352	1.7370	1.7388	1.7406	1.7424	1.7442	1.7460
1.45	1.7460	1.74781	1.74962	1.75143	1.75324	1.75505	1.75686	1.75867	1.76048	1.76229	1.7641
1.46	1.7641	1.76592	1.76774	1.76956	1.77138	1.77320	1.77502	1.77684	1.77866	1.78048	1.7823
1.47	1.7823	1.78412	1.78594	1.78776	1.78958	1.79140	1.79322	1.79504	1.79686	1.79868	1.8005
1.48	1.8005	1.80233	1.80416	1.80599	1.80782	1.80965	1.81148	1.81331	1.81514	1.81697	1.8188
1.49	1.8188	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE 6.—*Three-halves powers for numbers from 0 to 12.*

Units. / Hundredths.	0	1	2	3	4	5	6	7	8	9	10	11
0.00	0.0000	1.0000	2.8284	5.1962	8.0000	11.1803	14.6969	18.5203	22.6274	27.0000	31.6228	36.4829
.01	.0010	1.0150	2.8497	5.2222	8.0300	11.2139	14.7337	18.5600	22.6699	27.0450	31.6702	36.5326
.02	.0028	1.0302	2.8710	5.2482	8.0601	11.2475	14.7705	18.5997	22.7123	27.0890	31.7177	36.5824
.03	.0052	1.0453	2.8923	5.2743	8.0902	11.2811	14.8073	18.6394	22.7548	27.1351	31.7652	36.6322
.04	.0080	1.0606	2.9137	5.3004	8.1203	11.3148	14.8442	18.6792	22.7973	27.1802	31.8127	36.6820
.05	.0112	1.0759	2.9352	5.3266	8.1505	11.3485	14.8810	18.7190	22.8399	27.2253	31.8602	36.7319
.06	.0147	1.0913	2.9567	5.3528	8.1807	11.3822	14.9179	18.7589	22.8825	27.2705	31.9078	36.7818
.07	.0185	1.1068	2.9782	5.3791	8.2109	11.4160	14.9549	18.7988	22.9251	27.3156	31.9554	36.8317
.08	.0226	1.1224	2.9998	5.4054	8.2412	11.4497	14.9919	18.8387	22.9677	27.3608	32.0030	36.8816
.09	.0270	1.1380	3.0215	5.4317	8.2715	11.4836	15.0289	18.8786	23.0103	27.4060	32.0506	36.9315
0.10	0.0316	1.1537	3.0432	5.4581	8.3019	11.5174	15.0659	18.9185	23.0530	27.4512	32.0983	36.9815
.11	.0365	1.1695	3.0650	5.4845	8.3323	11.5513	15.1030	18.9585	23.0957	27.4965	32.1460	37.0315
.12	.0416	1.1853	3.0868	5.5110	8.3627	11.5852	15.1400	18.9985	23.1384	27.5418	32.1937	37.0815
.13	.0469	1.2012	3.1086	5.5375	8.3932	11.6192	15.1772	19.0386	23.1812	27.5871	32.2414	37.1315
.14	.0524	1.2172	3.1306	5.5641	8.4237	11.6532	15.2143	19.0786	23.2240	27.6324	32.2892	37.1816
.15	.0581	1.2332	3.1525	5.5907	8.4542	11.6872	15.2515	19.1187	23.2668	27.6778	32.3370	37.2317
.16	.0640	1.2494	3.1745	5.6173	8.4848	11.7213	15.2887	19.1589	23.3096	27.7232	32.3848	37.2817
.17	.0701	1.2656	3.1966	5.6440	8.5154	11.7554	15.3260	19.1990	23.3525	27.7686	32.4326	37.3319
.18	.0764	1.2818	3.2187	5.6708	8.5460	11.7895	15.3632	19.2392	23.3954	27.8140	32.4804	37.3820
.19	.0828	1.2981	3.2409	5.6975	8.5767	11.8236	15.4005	19.2794	23.4383	27.8595	32.5283	37.4322

TABLE 6.—*Three-halves powers for numbers from 0 to 12*—Continued.

Units. Hundredths.	0	1	2	3	4	5	6	7	8	9	10	11
0.20	0.0894	1.3145	3.2631	5.7243	8.6074	11.8578	15.4379	19.3196	23.4812	27.9050	32.5762	37.4824
.21	.0962	1.3310	3.2854	5.7512	8.6382	11.8920	15.4752	19.3599	23.5242	27.9514	32.6241	37.5326
.22	.1032	1.3475	3.3077	5.7781	8.6690	11.9263	15.5126	19.4002	23.5672	27.9960	32.6720	37.5828
.23	.1103	1.3641	3.3301	5.8050	8.6998	11.9606	15.5501	19.4405	23.6102	28.0416	32.7200	37.6331
.24	.1176	1.3808	3.3525	5.8320	8.7307	11.9949	15.5866	19.4808	23.6533	28.0872	32.7680	37.6833
.25	.1250	1.3975	3.3750	5.8590	8.7616	12.0293	15.6250	19.5212	23.6963	28.1328	32.8160	37.7336
.26	.1326	1.4144	3.3975	5.8861	8.7925	12.0636	15.6616	19.5576	23.7394	28.1784	32.8640	37.7840
.27	.1403	1.4312	3.4201	5.9132	8.8235	12.0981	15.7001	19.6021	23.7825	28.2241	32.9121	37.8343
.28	.1482	1.4482	3.4427	5.9403	8.8545	12.1325	15.7376	19.6425	23.8257	28.2698	32.9600	37.8847
.29	.1562	1.4652	3.4654	5.9675	8.8856	12.1670	15.7752	19.6830	23.8689	28.3155	33.0083	37.9351
0.30	0.1643	1.4822	3.4881	5.9947	8.9167	12.2015	15.8129	19.7235	23.9121	28.3612	33.0564	37.9855
.31	.1726	1.4994	3.5109	6.0220	8.9478	12.2361	15.8505	19.7641	23.9553	28.4069	33.1046	38.0359
.32	.1810	1.5166	3.5337	6.0493	8.9790	12.2706	15.8882	19.8046	23.9986	28.4527	33.1527	38.0864
.33	.1896	1.5338	3.5566	6.0767	9.0102	12.3053	15.9260	19.8452	24.0418	28.4985	33.2009	38.1369
.34	.1983	1.5512	3.5795	6.1041	9.0414	12.3399	15.9637	19.8858	24.0851	28.5444	33.2492	38.1874
.35	.2071	1.5686	3.6025	6.1315	9.0726	12.3746	16.0015	19.9265	24.1285	28.5902	33.2974	38.2379
.36	.2160	1.5860	3.6255	6.1590	9.1040	12.4093	16.0393	19.9672	24.1718	28.6361	33.3457	38.2884
.37	.2251	1.6035	3.6486	6.1865	9.1353	12.4440	16.0772	20.0079	24.2152	28.6820	33.3940	38.3390
.38	.2342	1.6211	3.6717	6.2141	9.1667	12.4788	16.1150	20.0486	24.2586	28.7279	33.4423	38.3896
.39	.2436	1.6388	3.6949	6.2417	9.1981	12.5136	16.1529	20.0894	24.3021	28.7739	33.4906	38.4402
0.40	0.2530	1.6565	3.7181	6.2693	9.2295	12.5485	16.1909	20.1302	24.3455	28.8199	33.5390	38.4908
.41	.2625	1.6743	3.7413	6.2970	9.2610	12.5833	16.2288	20.1710	24.3890	28.8659	33.5874	38.5415
.42	.2722	1.6921	3.7646	6.3247	9.2925	12.6182	16.2668	20.2118	24.4325	28.9119	33.6358	38.5922
.43	.282	1.7100	3.7880	6.3525	9.3241	12.6532	16.3048	20.2527	24.4761	28.9579	33.6842	38.6429
.44	.2919	1.7280	3.8114	6.3803	9.3557	12.6882	16.3429	20.2936	24.5196	29.0040	33.7327	38.6936
.45	.3019	1.7460	3.8349	6.4081	9.3873	12.7232	16.3810	20.3345	24.5632	29.0501	33.7811	38.7443
.46	.3120	1.7641	3.8584	6.4360	9.4189	12.7582	16.4191	20.3755	24.6068	29.0962	33.8297	38.7951
.47	.3222	1.7823	3.8819	6.4639	9.4506	12.7933	16.4572	20.4165	24.6505	29.1424	33.8782	38.8459
.48	.3325	1.8005	3.9055	6.4919	9.4824	12.8284	16.4954	20.4575	24.6941	29.1885	33.9267	38.8967
.49	.3430	1.8188	3.9292	6.5199	9.5141	12.8635	16.5336	20.4985	24.7378	29.2347	33.9753	38.9475
0.50	0.3536	1.8371	3.9529	6.5479	9.5459	12.8986	16.5718	20.5396	24.7815	29.2810	34.0239	38.9984
.51	.3642	1.8555	3.9766	6.5760	9.5778	12.9338	16.6101	20.5807	24.8253	29.3272	34.0725	39.0493
.52	.3750	1.8740	4.0004	6.6041	9.6097	12.9691	16.6484	20.6218	24.8691	29.3735	34.1211	39.1002
.53	.3858	1.8925	4.0242	6.6323	9.6416	13.0043	16.6867	20.6630	24.9129	29.4198	34.1698	39.1511
.54	.3968	1.9111	4.0481	6.6605	9.6735	13.0396	16.7250	20.7041	24.9567	29.4661	34.2185	39.2020
.55	.4079	1.9297	4.0720	6.6887	9.7055	13.0749	16.7634	20.7453	25.0005	29.5124	34.2672	39.2530
.56	.4191	1.9484	4.0960	6.7170	9.7375	13.1103	16.8018	20.7866	25.0444	29.5588	34.3159	39.3040
.57	.4303	1.9672	4.1200	6.7453	9.7695	13.1457	16.8402	20.8278	25.0883	29.6052	34.3647	39.3550
.58	.4417	1.9860	4.1441	6.7737	9.8016	13.1811	16.8787	20.8691	25.1322	29.6516	34.4135	39.4060
.59	.4532	2.0049	4.1682	6.8021	9.8337	13.2165	16.9172	20.9104	25.1762	29.6980	34.4623	39.4571
0.60	0.4648	2.0238	4.1924	6.8305	9.8659	13.2520	16.9557	20.9518	25.2202	29.7445	34.5111	39.5082
.61	.4764	2.0429	4.2166	6.8590	9.8981	13.2875	16.9943	20.9931	25.2642	29.7910	34.5599	39.5593
.62	.4882	2.0619	4.2408	6.8875	9.9303	13.3231	17.0328	21.0345	25.3082	29.8375	34.6088	39.6104
.63	.5000	2.0810	4.2651	6.9161	9.9626	13.3587	17.0714	21.0759	25.3522	29.8841	34.6577	39.6615
.64	.5120	2.1002	4.2895	6.9447	9.9949	13.3943	17.1101	21.1174	25.3963	29.9306	34.7066	39.7127
.65	.5240	2.1195	4.3139	6.9733	10.0272	13.4299	17.1488	21.1589	25.4404	29.9772	34.7557	39.7639
.66	.5362	2.1388	4.3383	7.0020	10.0596	13.4656	17.1874	21.2004	25.4845	30.0238	34.8045	39.8151
.67	.5484	2.1581	4.3628	7.0307	10.0920	13.5013	17.2172	21.2419	25.5287	30.0704	34.8535	39.8663
.68	.5607	2.1775	4.3874	7.0595	10.1244	13.5370	17.2649	21.2834	25.5729	30.1171	34.9025	39.9176
.69	.5732	2.1970	4.4119	7.0883	10.1569	13.5728	17.3037	21.3250	25.6171	30.1638	34.9516	39.9689

TABLE 6.—*Three-halves powers for numbers from 0 to 12*—Continued.

Units. / Hundredths.	0	1	2	3	4	5	6	7	8	9	10	11
0.70	0.5857	2.2165	4.4366	7.1171	10.1894	13.6086	17.3425	21.3666	25.6613	30.2105	35.0006	40.0202
.71	.5983	2.2361	4.4612	7.1460	10.2214	13.6444	17.3814	21.4083	25.7056	30.2572	35.0497	40.0715
.72	.6109	2.2558	4.4859	7.1749	10.2545	13.6803	17.4202	21.4499	25.7499	30.3040	35.0988	40.1228
.73	.6237	2.2755	4.5107	7.2038	10.2871	13.7161	17.4591	21.4916	25.7942	30.3507	35.1479	40.1742
.74	.6366	2.2952	4.5355	7.2328	10.3197	13.7521	17.4981	21.5333	25.8395	30.3975	35.1971	40.2256
.75	.6495	2.3150	4.5604	7.2618	10.3524	13.7880	17.5370	21.5751	25.8828	30.4444	35.2462	40.2770
.76	.6626	2.3349	4.5853	7.2909	10.3851	13.8240	17.5760	21.6169	25.9272	30.4912	35.2954	40.3284
.77	.6757	2.3548	4.6102	7.3200	10.4178	13.8600	17.6150	21.6587	25.9716	30.5381	35.3446	40.3798
.78	.6889	2.3748	4.6352	7.3492	10.4506	13.8961	17.6541	21.7005	26.0161	30.5850	35.3939	40.4313
.79	.7022	2.3949	4.6602	7.3783	10.4834	13.9321	17.6931	21.7423	26.0605	30.6319	35.4431	40.4828
0.80	0.7155	2.4150	4.6853	7.4076	10.5163	13.9682	17.7322	21.7842	26.1050	30.6789	35.4924	40.5343
.81	.7290	2.4351	4.7104	7.4368	10.5492	14.0044	17.7714	21.8261	26.1495	30.7258	35.5417	40.5859
.82	.7425	2.4553	4.7356	7.4661	10.5812	14.0406	17.8105	21.8681	26.1941	30.7728	35.5911	40.6374
.83	.7562	2.4756	4.7608	7.4955	10.6150	14.0768	17.8507	21.9100	26.2386	30.8198	35.6404	40.6890
.84	.7699	2.4959	4.7861	7.5248	10.6480	14.1130	17.8889	21.9520	26.2832	30.8669	35.6898	40.7406
.85	.7837	2.5163	4.8114	7.5542	10.6810	14.1493	17.9282	21.9940	26.3278	30.9139	35.7392	40.7922
.86	.7975	2.5367	4.8367	7.5837	10.7141	14.1856	17.9674	22.0361	26.3725	30.9610	35.7886	40.8439
.87	.8115	2.5572	4.8621	7.6132	10.7472	14.2219	18.0067	22.0781	26.4171	31.0081	35.8380	40.8955
.88	.8255	2.5777	4.8875	7.6427	10.7803	14.2582	18.0461	22.1202	26.4618	31.0553	35.8875	40.9472
.89	.8396	2.5983	4.9130	7.6723	10.8134	14.2946	18.0854	22.1623	26.5065	31.1024	35.9370	40.9989
0.90	0.8538	2.6190	4.9385	7.7019	10.8466	14.3311	18.1248	22.2045	26.5523	31.1496	35.9865	41.0507
.91	.8681	2.6397	4.9641	7.7315	10.8798	14.3675	18.1642	22.2467	26.5960	31.1968	36.0360	41.1024
.92	.8824	2.6604	4.9897	7.7702	10.9131	14.4040	18.2037	22.2889	26.6408	31.2441	36.0856	41.1542
.93	.8969	2.6812	5.0154	7.7909	10.9464	14.4405	18.2432	22.3311	26.6856	31.2913	36.1352	41.2060
.94	.9114	2.7021	5.0411	7.8207	10.9797	14.4770	18.2827	22.3733	26.7305	31.3386	36.1848	41.2578
.95	.9259	2.7230	5.0668	7.8505	11.0131	14.5136	18.3222	22.4156	26.7753	31.3850	36.2344	41 3097
.96	.9406	2.7440	5.0926	7.8803	11.0464	14.5502	18.3617	22.4579	26.8202	31.4332	36.2841	41.3615
.97	.9553	2.7650	5.1184	7.9102	11.0799	14.5869	18.4013	22.5003	26.8651	31.4806	36.3337	41.4134
.98	.9702	2.7861	5.1443	7.9401	11.1133	14.6235	18.4409	22.5426	26.9100	31.5280	36.3834	41.4653
.99	.9850	2.8072	5.1702	7.9700	11.1468	14.6602	18.4806	22.5850	26.9550	31.5754	36.4331	41.5173
1.00	1.0000	2.8284	5.1962	8.0000	11.1803	14.6969	18.5203	22.6274	27.0000	31.6228	36.4829	41.5692

The tables of three-halves powers may conveniently be used in conjunction with Crelle's Rechentafeln or similar tables of the products of pairs of factors. C will usually be constant, or nearly so. Entering Crelle's tables with C or CL as an argument, the discharge corresponding to values of $H^{\frac{3}{2}}$ read from the tables here given may be taken out directly, and usually with sufficient precision at least for 1 foot length of crest, without any arithmetical computation. Table 5 gives $H^{\frac{3}{2}}$ for values of H from zero to 1.5 feet, advancing by thousandths. In Table 6 the increment is 0.1 foot, and the range zero to 12 feet. Should $H^{\frac{3}{2}}$ be required for larger values of H, it may be found from the three-halves power of $\frac{1}{4}H$, by the formula

$$H^{\frac{3}{2}}=8\left(\frac{H}{4}\right)^{\frac{3}{2}} \quad \ldots\ldots\ldots \quad (114)$$

TABLE 7.—FLOW OVER BROAD-CRESTED WEIRS, WITH STABLE NAPPE.

This table gives values of

$$Q = C_1 L H^{\frac{3}{2}},$$

where

$$L = 1$$
$$C_1 = 2.64$$

The derivation of this coefficient is given in connection with discussion of broad-crested weirs (pp. 119–121). It may be applied to broad-crested weirs of any width of cross section exceeding 2 feet within such limiting heads that the nappe does not adhere to the downstream face of the weir for low heads nor tend to become detached with increased head. Under the latter condition the coefficient increases to a limit near the value which applies for a thin-edged weir, a point being finally reached where the nappe breaks entirely free from the broad crest and discharges in the same manner as for a thin-edged weir. The coefficient, 2.64, may often be applied for weirs exceeding 2-feet crest width and for heads from 0.5 foot up to 1.5 or 2 times the breadth of weir crest. If corrections for the velocity of approach are required the Francis correction formula, or its equivalent, should be used.

TABLE 7.—*Weir discharge per foot of crest length.*

[Coefficient $C_1 = 2.64$.]

Head *H*, feet. / Units. Hundredths.	0	1	2	3	4	5	6	7	8	9	10
0.00	0.000	2.64	7.47	13.7	21.1	29.5	38.8	48.9	59.7	71.3	83.5
.01	.003	2.68	7.52	13.8	21.2	29.6	38.9	49.0	59.8	71.4	83.6
.02	.007	2.72	7.58	13.8	21.3	29.7	39.0	49.1	59.9	71.5	83.7
.03	.014	2.76	7.64	13.9	21.4	29.8	39.1	49.2	60.1	71.6	83.9
.04	.021	2.80	7.69	14.0	21.4	29.9	39.2	49.3	60.2	71.7	84.0
.05	.030	2.84	7.75	14.1	21.5	30.0	39.3	49.4	60.3	71.9	84.1
.06	.039	2.88	7.81	14.1	21.6	30.0	39.4	49.5	60.4	72.0	84.2
.07	.049	2.92	7.86	14.2	21.7	30.1	39.5	49.6	60.5	72.1	84.4
.08	.060	2.96	7.92	14.3	21.8	30.2	39.6	49.7	60.6	72.2	84.5
.09	.071	3.00	7.98	14.3	21.8	30.3	39.7	49.8	60.7	72.3	84.6
0.10	0.083	3.04	8.03	14.4	21.9	30.4	39.8	49.9	60.8	72.5	84.7
.11	.096	3.09	8.09	14.5	22.0	30.5	39.9	50.0	61.0	72.6	84.9
.12	.110	3.13	8.15	14.5	22.1	30.6	40.0	50.2	61.1	72.7	85.0
.13	.124	3.17	8.21	14.6	22.2	30.7	40.1	50.3	61.2	72.8	85.1
.14	.138	3.21	8.26	14.7	22.2	30.8	40.2	50.4	61.3	72.9	85.2
.15	.153	3.26	8.32	14.8	22.3	30.8	40.3	50.5	61.4	73.1	85.4
.16	.169	3.30	8.38	14.8	22.4	30.9	40.4	50.6	61.5	73.2	85.5
.17	.185	3.34	8.44	14.9	22.5	31.0	40.5	50.7	61.6	73.3	85.6
.18	.202	3.38	8.50	15.0	22.6	31.1	40.6	50.8	61.8	73.4	85.7
.19	.218	3.43	8.56	15.0	22.6	31.2	40.7	50.9	61.9	73.5	85.9

TABLE 7.—*Weir discharge per foot of crest length*—Continued.

Head *H*, feet. / Units. Hundredths.	0	1	2	3	4	5	6	7	8	9	10
0.20	0.236	3.47	8.61	15.1	22.7	31.3	40.8	51.0	62.0	73.7	86.0
.21	.254	3.51	8.67	15.2	22.8	31.4	40.9	51.1	62.1	73.8	86.1
.22	.272	3.56	8.73	15.2	22.9	31.5	41.0	51.2	62.2	73.9	86.2
.23	.291	3.60	8.79	15.3	23.0	31.6	41.0	51.3	62.3	74.0	86.4
.24	.310	3.64	8.85	15.4	23.0	31.7	41.1	51.4	62.4	74.1	86.5
.25	.330	3.69	8.91	16.5	23.1	31.8	41.2	51.5	62.6	74.3	86.6
.26	.350	3.73	8.97	15.5	23.2	31.8	41.3	51.6	62.7	74.4	86.8
.27	.370	3.78	9.03	15.6	23.3	31.9	41.4	51.7	62.8	74.5	86.9
.28	.391	3.82	9.09	15.7	23.4	32.0	41.5	51.9	62.9	74.6	87.0
.29	.412	3.87	9.15	15.8	23.4	32.1	41.6	52.0	63.0	74.8	87.1
0.30	0.434	3.91	9.21	15.8	23.5	32.2	41.7	52.1	63.1	74.9	87.3
.31	.456	3.96	9.27	15.9	23.6	32.3	41.8	52.2	63.2	75.0	87.4
.32	.478	4.00	9.33	16.0	23.7	32.4	41.9	52.3	63.4	75.1	87.5
.33	.500	4.05	9.39	16.0	23.8	32.5	42.0	52.4	63.5	75.2	87.6
.34	.524	4.10	9.45	16.2	23.9	32.6	42.1	52.5	63.6	75.4	87.8
.35	.547	4.14	9.51	16.2	24.0	32.7	42.2	52.6	63.7	75.5	87.9
.36	.570	4.19	9.57	16.3	24.1	32.8	42.3	52.7	63.8	75.6	88.0
.37	.594	4.23	9.63	16.3	24.1	32.8	42.4	52.8	63.9	75.7	88.2
.38	.618	4.28	9.69	16.4	24.2	32.9	42.5	52.9	64.0	75.8	88.3
.39	.643	4.33	9.75	16.5	24.3	33.0	42.6	53.0	64.2	76.0	88.4
0.40	0.668	4.37	9.82	16.6	24.4	33.1	42.7	53.1	64.3	76.1	88.5
.41	.693	4.42	9.88	16.6	24.4	33.2	42.8	53.2	64.4	76.2	88.7
.42	.719	4.47	9.94	16.7	24.5	33.3	42.9	53.4	64.5	76.3	88.8
.43	.744	4.51	10.0	16.8	24.6	33.4	43.0	53.5	64.6	76.4	88.9
.44	.771	4.56	10.1	16.8	24.7	33.5	43.1	53.6	64.7	76.6	89.0
.45	.797	4.61	10.1	16.9	24.8	33.6	43.2	53.7	64.8	76.7	89.2
.46	.824	4.66	10.2	17.0	24.9	33.7	43.3	53.8	65.0	76.8	89.3
.47	.851	4.70	10.2	17.1	24.9	33.8	43.4	53.9	65.1	76.9	89.4
.48	.878	4.75	10.3	17.1	25.0	33.9	43.6	54.0	65.2	77.0	89.6
.49	.905	4.80	10.4	17.2	25.1	34.0	43.6	54.1	65.3	77.2	89.7
0.50	0.934	4.85	10.4	17.3	25.2	34.0	43.7	54.2	65.4	77.3	89.8
.51	.961	4.90	10.5	17.4	25.3	34.1	43.8	54.3	65.5	77.4	90.0
.52	.990	4.95	10.6	17.4	25.4	34.2	44.0	54.4	65.6	77.5	90.1
.53	1.02	5.00	10.6	17.5	25.4	34.3	44.1	54.6	65.8	77.7	90.2
.54	1.05	5.04	10.7	17.6	25.5	34.4	44.2	54.7	65.9	77.8	90.3
.55	1.08	5.09	10.8	17.7	25.6	34.5	44.3	54.8	66.0	77.9	90.5
.56	1.11	5.14	10.8	17.7	25.7	34.6	44.4	54.9	66.1	78.0	90.6
.57	1.14	5.19	10.9	17.8	25.8	34.7	44.5	55.0	66.2	78.2	90.7
.58	1.17	5.24	10.9	17.9	25.9	34.8	44.6	55.1	66.3	78.3	90.8
.59	1.20	5.29	11.0	18.0	26.0	34.9	44.7	55.2	66.5	78.4	91.0
0.60	1.23	5.34	11.1	18.0	26.0	35.0	44.8	55.3	66.6	78.5	91.1
.61	1.26	5.39	11.1	18.1	26.1	35.1	44.9	55.4	66.7	78.6	91.2
.62	1.29	5.44	11.2	18.2	26.2	35.2	45.0	55.5	66.8	78.8	91.4
.63	1.32	5.49	11.2	18.2	26.3	35.3	45.1	55.6	66.9	78.9	91.5
.64	1.35	5.54	11.3	18.3	26.4	35.4	45.2	55.7	67.0	79.0	91.6
.65	1.38	5.60	11.4	18.4	26.5	35.4	45.3	55.9	67.2	79.1	91.8
.66	1.42	5.65	11.4	18.5	26.6	35.5	45.4	56.0	67.3	79.3	91.9
.67	1.45	5.70	11.5	18.6	26.6	35.6	45.5	56.1	67.4	79.4	92.0
.68	1.48	5.75	11.6	18.6	26.7	35.7	45.6	56.2	67.5	79.5	92.1
.69	1.51	5.80	11.6	18.7	26.8	35.8	45.7	56.3	67.6	79.6	92.3

TABLE 7.—*Weir discharge per foot of crest length*—Continued.

Head *H*, feet. / Units. Hundredths.	0	1	2	3	4	5	6	7	8	9	10
0.70	1.55	5.85	11.7	18.8	26.9	35.9	45.8	56.4	67.7	79.8	92.4
.71	1.58	5.90	11.8	18.9	27.0	36.0	45.9	56.5	67.9	79.9	92.5
.72	1.61	5.96	11.8	18.9	27.1	36.1	46.0	56.6	68.0	80.0	92.7
.73	1.65	6.01	11.9	19.0	27.2	36.2	46.1	56.7	68.1	80.1	92.8
.74	1.68	6.06	12.0	19.1	27.2	36.3	46.2	56.8	68.2	80.2	92.9
.75	1.71	6.11	12.0	19.2	27.3	36.4	46.3	57.0	68.3	80.4	93.0
.76	1.75	6.16	12.1	19.2	27.4	36.5	46.4	57.1	68.4	80.5	93.2
.77	1.78	6.22	12.2	19.3	27.5	36.6	46.5	57.2	68.6	80.6	93.3
.78	1.82	6.27	12.2	19.4	27.6	36.7	46.6	57.3	68.7	80.7	93.4
.79	1.85	6.32	12.3	19.5	27.7	36.8	46.7	57.4	68.8	80.9	93.6
0.80	1.89	6.38	12.4	19.6	27.8	36.9	46.8	57.5	68.9	81.0	93.7
.81	1.92	6.43	12.4	19.6	27.8	37.0	46.9	57.6	69.0	81.1	93.8
.82	1.96	6.48	12.5	19.7	27.9	37.1	47.0	57.7	69.2	81.2	94.0
.83	2.00	6.54	12.6	19.8	28.0	37.2	47.1	57.8	69.3	81.4	94.1
.84	2.03	6.59	12.6	19.9	28.1	37.3	47.2	58.0	69.4	81.5	94.2
.85	2.07	6.64	12.7	19.9	28.2	37.4	47.3	58.1	69.5	81.6	94.4
.86	2.10	6.70	12.8	20.0	28.3	37.4	47.4	58.2	69.6	81.7	94.5
.87	2.14	6.75	12.8	20.1	28.4	37.5	47.5	58.3	69.7	81.9	94.6
.88	2.18	6.80	12.9	20.2	28.5	37.6	47.6	58.4	69.9	82.0	94.7
.89	2.22	6.86	13.0	20.2	28.5	37.7	47.7	58.5	70.0	82.1	94.9
0.90	2.25	6.91	13.0	20.3	28.6	37.8	47.8	58.6	70.1	82.2	95.0
.91	2.29	6.97	13.1	20.4	28.7	37.9	48.0	58.7	70.2	82.4	95.1
.92	2.33	7.02	13.2	20.5	28.8	38.0	48.1	58.8	70.3	82.5	95.3
.93	2.37	7.08	13.2	20.6	28.9	38.1	48.2	59.0	70.4	82.6	95.4
.94	2.41	7.13	13.3	20.6	29.0	38.2	48.3	59.1	70.6	82.7	95.5
.95	2.44	7.19	13.4	20.7	29.1	38.3	48.4	59.2	70.7	82.9	95.6
.96	2.48	7.24	13.4	20.8	29.2	38.4	48.5	59.3	70.8	83.0	95.8
.97	2.52	7.30	13.5	20.9	29.3	38.5	48.6	59.4	70.9	83.1	95.9
.98	2.56	7.36	13.6	21.0	29.3	38.6	48 7	59.5	71.0	83.2	96.0
.99	2.60	7.41	13.6	21.0	29.4	38.7	48.8	59.6	71.2	83.4	96.2
1.00	2.64	7.47	13.7	21.1	29.5	38.8	48.9	59.7	71.3	83.5	96.3

TABLE 8.—BACKWATER CAUSED BY A DAM OR WEIR.

In a channel of uniform depth, width, and slope, let

D=Original uniform depth.
d_2=Depth at the dam or obstruction.
d_1=Depth at a point upstream.
l=Distance upstream to the point d_1.
w=Width of channel.
l_1=Distance upstream to the "hydrostatic limit."
S=Natural uniform slope or inclination of water surface and stream bed, assumed parallel.
g=Acceleration of gravity.
C=Coefficient in the Chezy or slope formula $v=C\sqrt{RS}$,

where R is the hydraulic radius$=\frac{\text{area of section}}{\text{wetted perimeter}}$.

The value of C varies for rivers from about 50 to 140.

The distance upstream from the obstruction at which the depth will be d_1 may be found by the formula

$$l=\frac{d_2-d_1}{S}+D\left(\frac{1}{S}-\frac{C^2}{g}\right)\left[F_1-F_2\right] \quad . \quad . \quad . \quad (115)$$

F is a function of $\frac{d}{D}$, whose value can be expressed mathematically only as a transcendental equation. The numerical values of this function are given in Table 8. F_1 will be found opposite the argument $\frac{D}{d_1}$, and F_2 opposite $\frac{D}{d_2}$.

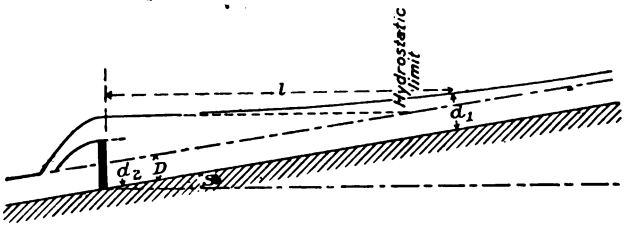


FIG. 15.—Concave backwater surface.

The inverse problem of finding the depth at any given distance l upstream can be solved only by successive trials.

Using the above equation, a series of values of d_1 may be determined giving in tabular form the corresponding values of l. From this data the form of the surface curve may be graphically shown or the depth of back piling at any point may be interpolated.

If $D=5$, $d_2=10$, $C=75$, $S=0.0001$, $\frac{D}{d_2}=0.5$, and $F_2=0.1318$,

$$D\left(\frac{1}{S}-\frac{C^2}{g}\right)=5\left(10000-\frac{75^2}{32.16}\right)=49625.$$

Column (2) in the following table gives the values of l for various values of d_1 computed by means of formula (115).

Form of backwater curve above a dam.

d	l	δ	$d_1-\delta$
Depth, feet (1).	Distance from dam to depth d_1, feet (2).	Hydrostatic depth at distance l, feet (3).	Depth of "back piling," feet (4).
9	11,687	8.83	.17
8	24,277	7.57	.43
7	38,526	6.15	.85
6.5	47,024	5.30	1.20
6.4	48,798	5.13	1.27
6.3	50,796	[a]5.00	1.30
6.2	52,813	[a]5.00	1.20
6.1	55,010	[a]5.00	1.10
6	57,240	[a]5.00	1.00
5.5	67,252	[a]5.00	.50
5.3	82,940	[a]5.00	.30
5.1	101,255	[a]5.00	.10

[a] Above hydrostatic limit.

If the pond formed by the dam were level, the *hydrostatic depth* δ at any distance upstream would be

$$\delta = d_2 - l \sin S \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (116)$$

Column (3) in the above table shows this factor for the several values of l. The true "back piling" or rise due to the *surface curvature* is expressed by the difference $d_1-\delta$, as given in column (4).

This quantity has a maximum value at the *hydrostatic limit*, or terminus of the level pond, where $\delta = D$.

Its location is such that if l_1 is the distance upstream from the dam

$$l_1 = \frac{d_2 - D}{\sin S} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (117)$$

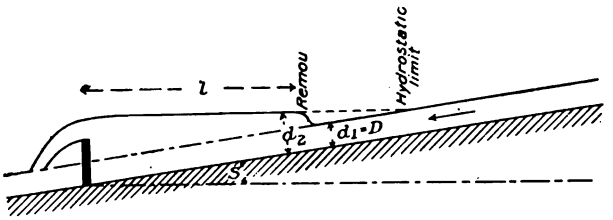


FIG. 16.—Convex backwater surface.

In the example given the hydrostatic limit occurs at a distance l_1=50,000 feet above the dam, at which point the maximum back piling of about 1.31 feet occurs.

Above the hydrostatic limit the depth of back piling is d_1-D.

When $$S \geqq \frac{g}{C^2} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (118)$$

the pond surface will not be concave, but a *remou* or hydraulic jump will occur, having a height

$$d_2 = 2\sqrt{d_1 \frac{v_1^2}{2g}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (119)$$

where v_1 is the mean velocity corresponding to d_1. To find the distance upstream to the point where the jump occurs, solve equation (115) for the value of d_2, found by formula (119).

If $S=0.004$ $\quad C=100$ $\quad \frac{g}{C^2}=0.003216.$

If $d_1=5$ $\quad w=100$ $\quad D=5$ $\quad R=\frac{500}{110}=4.55.$

$$v_1=100\sqrt{4.55\,\frac{4}{1000}}=13.49 \text{ feet per second.}$$

$$d_2=2\sqrt{d_1\frac{v_1^2}{2g}}=2\sqrt{5\,\frac{185}{64.32}}=7.48.$$

Let the depth at the dam be 10 feet; using d_2 as found above as the terminal depth in formula (115), we obtain

$$l=\frac{10-7.48}{0.004}+5\left(\frac{1}{0.004}-311\right)(F_2-F_1)$$

$$\frac{D}{d_1}=\frac{5}{7.48}=0.669 \qquad \frac{D}{d_2}=0.5$$

$$F_1=0.2578 \qquad F_2=0.1318$$

$$l=630+(250-311)\times 0.126=622.3 \text{ feet.}$$

The hydrostatic limit in this case is

$$l_1=\frac{10-5}{0.004}=1{,}250 \text{ feet.}$$

If the channel above an obstruction consists of successive reaches having different slopes or cross sections, the depth at the head of the first reach or level may be found by the method outlined, and using this as the initial depth d_2, a similar solution may be made for the second and succeeding levels.[a]

[a] Table 8 has been extended from Bresse's original table by interpolation. Demonstrations of the formulas here given may be found in Merriman's or Bovey's Hydraulics. In case of a fall a different function must be employed. Its values will be found in the works mentioned.

TABLE 8.—*Backwater function (F) for a dam or obstruction.*

[The column headings are hundredths for values of $\frac{D}{d}$ from zero to 0.29, thousandths for values of $\frac{D}{d}$ from 0.30 to 0.899, and ten-thousandths for values of $\frac{D}{d}$ from 0.900 to 0.999.]

$\frac{D}{d}$	0	1	2	3	4	5	6	7	8	9
	F	*F*	*F*	*F*	*F*	*F*	*F*	*F*	*F*	*F*
0.0	0.0000	0.0001	0.0003	0.0005	0.0009	0.0013	0.0018	0.0026	0.0034	0.0042
.1	.0050	.0061	.0072	.0085	.0098	.0113	.0128	.0045	.0162	.0181
.2	.0201	.0221	.0243	.0266	.0290	.0314	.0340	.0367	.0395	.0425
0.30	0.0455	0.0458	0.0461	0.0464	0.0467	0.0471	0.0474	0.0477	0.0480	0.0483
.31	.0486	.0489	.0493	.0496	.0499	.0503	.0506	.0509	.0512	.0516
.32	.0519	.0522	.0526	.0529	.0533	.0536	.0539	.0543	.0546	.0550
.33	.0553	.0556	.0560	.0563	.0567	.0570	.0573	.0577	.0580	.0584
.34	.0587	.0591	.0594	.0598	.0601	.0605	.0609	.0612	.0616	.0619
.35	.0623	.0627	.0630	.0634	.0638	.0642	.0645	.0649	.0653	.0656
.36	.0660	.0664	.0668	.0672	.0676	.0680	.0683	.0687	.0691	.0695
.37	.0699	.0703	.0707	.0711	.0715	.0718	.0722	.0726	.0730	.0734
.38	.0738	.0742	.0746	.0750	.0754	.0758	.0763	.0767	.0771	.0775
.39	.0779	.0783	.0787	.0792	.0796	.0800	.0804	.0808	.0813	.0817
0.40	0.0821	0.0825	0.0830	0.0834	0.0839	0.0843	0.0847	0.0852	0.0856	0.0861
.41	.0865	.0869	.0874	.0878	.0883	.0887	.0891	.0896	.0900	.0905
.42	.0909	.0918	.0926	.0935	.0943	.0952	.0961	.0969	.0978	.0986
.43	.0995	.0996	.0997	.0997	.0998	.0999	.1000	.1001	.1001	.1002
.44	.1003	.1008	.1013	.1018	.1023	.1030	.1032	.1037	.1042	.1047
.45	.1052	.1057	.1062	.1067	.1072	.1077	.1082	.1087	.1092	.1097
.46	.1102	.1107	.1112	.1118	.1123	.1128	.1133	.1138	.1144	.1149
.47	.1154	.1159	.1165	.1170	.1175	.1180	.1186	.1191	.1196	.1202
.48	.1207	.1212	.1218	.1224	.1229	.1234	.1240	.1246	.1215	.1256
.49	.1262	.1268	.1273	.1279	.1284	.1290	.1296	.1301	.1307	.1312
0.50	0.1318	0.1324	0.1330	0.1335	0.1341	0.1347	0.1353	0.1359	0.1364	0.1370
.51	.1376	.1382	.1388	.1394	.1400	.1406	.1411	.1417	.1423	.1429
.52	.1435	.1441	.1447	.1454	.1460	.1466	.1472	.1478	.1485	.1491
.53	.1497	.1503	.1510	.1516	.1522	.1528	.1535	.1541	.1547	.1554
.54	.1560	.1566	.1573	.1580	.1586	.1592	.1599	.1606	.1612	.1618
.55	.1625	.1632	.1638	.1645	.1652	.1658	.1665	.1672	.1679	.1685
.56	.1692	.1699	.1706	.1713	.1720	.1726	.1733	.1740	.1747	.1754
.57	.1761	.1768	.1775	.1782	.1789	.1796	.1804	.1811	.1818	.1825
.58	.1832	.1839	.1847	.1854	.1861	.1868	.1876	.1883	.1890	.1898
.59	.1905	.1912	.1920	.1928	.1935	.1942	.1950	.1958	.1965	.1972
0.60	0.1980	0.1988	0.1996	0.2003	0.2011	0.2019	0.2027	0.2035	0.2042	0.2050
.61	.2058	.2066	.2074	.2082	.2090	.2098	.2106	.2114	.2122	.2130
.62	.2138	.2146	.2155	.2163	.2171	.2180	.2188	.2196	.2204	.2213
.63	.2221	.2230	.2238	.2246	.2255	.2264	.2272	.2280	.2289	.2298
.64	.2306	.2315	.2324	.2333	.2342	.2350	.2359	.2368	.2377	.2386
.65	.2395	.2404	.2413	.2422	.2431	.2440	.2450	.2459	.2468	.2477
.66	.2486	.2495	.2505	.2514	.2524	.2533	.2542	.2552	.2561	.2571
.67	.2580	.2589	.2597	.2606	.2615	.2624	.2632	.2641	.2650	.2658
.68	.2667	.2678	.2689	.2700	.2711	.2722	.2734	.2745	.2756	.2767
.69	.2778	.2788	.2799	.2810	.2820	.2830	.2841	.2852	.2862	.2872

TABLE 8.—*Backwater function* (F) *for a dam or obstruction*—Continued.

[The column headings are hundredths for values of $\frac{D}{d}$ from zero to 0.29, thousandths for values of $\frac{D}{d}$ from 0.30 to 0.899, and ten-thousandths for values of $\frac{D}{d}$ from 0.900 to 0.999.]

$\frac{D}{d}$	0	1	2	3	4	5	6	7	8	9
	F	F	F	F	F	F	F	F	F	F
0.70	0.2883	0.2894	0.2905	0.2915	0.2926	0.2937	0.2948	0.2959	0.2969	0.2980
.71	.2991	.3002	.3013	.3025	.3036	.3047	.3058	.3070	.3081	.3093
.72	.3104	.3116	.3127	.3139	.3150	.3162	.3174	.3186	.3197	.3209
.73	.3221	.3233	.3245	.3258	.3270	.3282	.3294	.3306	.3319	.3331
.74	.3343	.3356	.3368	.3381	.3393	.3406	.3419	.3432	.3444	.3457
.75	.3470	.3483	.3496	.3510	.3523	.3536	.3549	.3563	.3576	.3590
.76	.3603	.3617	.3630	.3644	.3657	.3671	.3685	.3699	.3713	.3727
.77	.3741	.3755	.3770	.3784	.3799	.3813	.3828	.3842	.3857	.3871
.78	.3886	.3901	.3916	.3932	.3947	.3962	.3977	.3993	.4008	.4024
.79	.4039	.4055	.4070	.4086	.4101	.4117	.4133	.4149	.4166	.4182
0.80	0.4198	0.4215	0.4231	0.4248	0.4264	0.4281	0.4298	0.4315	0.4333	0.4350
.81	.4367	.4384	.4402	.4419	.4437	.4454	.4472	.4490	.4508	.4526
.82	.4544	.4563	.4581	.4600	.4618	.4637	.4656	.4675	.4695	.4714
.83	.4733	.4753	.4772	.4792	.4811	.4831	.4851	.4871	.4892	.4912
.84	.4932	.4953	.4974	.4995	.5016	.5037	.5059	.5081	.5102	.5124
.85	.5146	.5168	.5191	.5213	.5236	.5258	.5281	.5304	.5328	.5351
.86	.5374	.5398	.5422	.5446	.5470	.5494	.5519	.5544	.5569	.5594
.87	.5619	.5645	.5671	.5697	.5723	.5749	.5776	.5803	.5830	.5857
.88	.5884	.5912	.5940	.5969	.5997	.6025	.6055	.6084	.6114	.6143
.89	.6173	.6204	.6235	.6265	.6296	.6327	.6359	.6392	.6424	.6457
0.900	0.6489	0.6492	0.6496	0.6499	.6502	0.6506	0.6509	0.6512	0.6515	0.6519
.901	.6522	.6525	.6529	.6532	.6536	.6539	.6542	.6546	.6549	.6553
.902	.6556	.6559	.6563	.6566	.6570	.6573	.6576	.6580	.6583	.6587
.903	.6590	.6594	.6597	.6600	.6604	.6608	.6611	.6614	.6618	.6622
.904	.6625	.6629	.6632	.6636	.6639	.6642	.6646	.6650	.6653	.6656
.905	.6660	.6664	.6667	.6670	.6674	.6678	.6681	.6684	.6688	.6692
.906	.6695	.6698	.6702	.6706	.6709	.6712	.6716	.6720	.6723	.6726
.907	.6730	.6734	.6737	.6741	.6744	.6748	.6752	.6755	.6759	.6762
.908	.6766	.6770	.6773	.6777	.6780	.6784	.6788	.6791	.6795	.6798
.909	.6802	.6806	.6809	.6813	.6817	.6820	.6824	.6828	.6832	.6835
0.910	0.6839	0.6843	0.6846	0.6850	0.6854	0.6858	0.6861	0.6865	0.6869	0.6872
.911	.6876	.6880	.6884	.6887	.6891	.6895	.6899	.6903	.6906	.6910
.912	.6914	.6918	.6922	.6925	.6929	.6933	.6937	.6941	.6944	.6948
.913	.6952	.6956	.6960	.6963	.6967	.6971	.6975	.6979	.6982	.6986
.914	.6990	.6994	.6998	.7002	.7006	.7010	.7013	.7017	.7021	.7025
.915	.7029	.7033	.7037	.7041	.7045	.7049	.7053	.7057	.7061	.7065
.916	.7069	.7073	.7077	.7081	.7085	.7089	.7093	.7097	.7101	.7105
.917	.7109	.7113	.7117	.7121	.7125	.7129	.7133	.7137	.7141	.7145
.918	.7149	.7153	.7157	.7161	.7165	.7170	.7174	.7178	.7182	.7186
.919	.7190	.7194	.7198	.7202	.7206	.7210	.7215	.7219	.7223	.7227
0.920	0.7231	0.7235	0.7239	0.7244	0.7248	0.7252	0.7256	0.7260	0.7265	0.7269
.921	.7273	.7277	.7281	.7286	.7290	.7294	.7298	.7302	.7307	.7311
.922	.7315	.7319	.7324	.7328	.7332	.7336	.7341	.7345	.7349	.7354
.923	.7358	.7362	.7367	.7371	.7375	.7380	.7384	.7388	.7392	.7397
.924	.7401	.7405	.7410	.7414	.7419	.7423	.7427	.7432	.7436	.7441
.925	.7445	.7450	.7454	.7458	.7463	.7468	.7472	.7476	.7481	.7486
.926	.7490	.7494	.7499	.7504	.7508	.7512	.7517	.7522	.7526	.7530
.927	.7535	.7540	.7544	.7549	.7553	.7558	.7563	.7567	.7572	.7576
.928	.7581	.7586	.7590	.7595	.7600	.7604	.7609	.7614	.7619	.7623
.929	.7628	.7633	.7637	.7642	.7647	.7652	.7656	.7661	.7666	.7670

TABLE 8.—*Backwater function* (F) *for a dam or obstruction*—Continued.

[The column headings are hundredths for values of $\frac{D}{d}$ from zero to 0.29, thousandths for values of $\frac{D}{d}$ from 0.30 to 0.899, and ten-thousandths for values of $\frac{D}{d}$ from 0.900 to 0.999.]

$\frac{D}{d}$	0	1	2	3	4	5	6	7	8	9
	F	F	F	F	F	F	F	F	F	F
0.930	0.7675	0.7680	0.7685	0.7689	0.7694	0.7699	0.7704	0.7709	0.7713	0.7718
.931	.7723	.7728	.7724	.7738	.7743	.7748	.7752	.7757	.7762	.7767
.932	.7772	.7777	.7782	.7787	.7792	.7796	.7801	.7806	.7811	.7816
.933	.7821	.7826	.7831	.7836	.7841	.7846	.7851	.7856	.7861	.7866
.934	.7871	.7876	.7881	.7886	.7891	.7896	.7902	.7907	.7912	.7917
.935	.7922	.7927	.7932	.7937	.7942	.7948	.7953	.7958	.7963	.7968
.936	.7973	.7978	.7984	.7989	.7994	.8000	.8005	.8010	.8015	.8021
.937	.8026	.8031	.8037	.8042	.8047	.8052	.8058	.8063	.8068	.8074
.938	.8079	.8084	.8090	.8095	.8101	.8106	.8111	.8117	.8122	.8128
.939	.8133	.8138	.8144	.8150	.8155	.8160	.8166	.8172	.8177	.8182
0.940	0.8188	0.8194	0.8199	0.8205	0.8210	0.8216	0.8222	0.8227	0.8233	0.8238
.941	.8244	.8250	.8256	.8262	.8268	.8274	.8280	.8286	.8292	.8298
.942	.8301	.8307	.8313	.8318	.8324	.8330	.8336	.8342	.8347	.8353
.943	.8359	.8365	.8371	.8377	.8383	.8388	.8394	.8400	.8406	.8412
.944	.8418	.8424	.8430	.8436	.8442	.8448	.8454	.8460	.8466	.8472
.945	.8478	.8484	.8490	.8496	.8502	.8508	.8515	.8521	.8527	.8533
.946	.8539	.8545	.8552	.8558	.8564	.8570	.8577	.8583	.8589	.8596
.947	.8602	.8608	.8615	.8621	.8627	.8634	.8640	.8646	.8652	.8659
.948	.8665	.8672	.8678	.8684	.8691	.8698	.8704	.8710	.8717	.8724
.949	.8730	.8736	.8743	.8750	.8756	.8762	.8769	.8776	.8782	.8788
0.950	0.8795	0.8802	0.8809	.8815	0.8822	0.8829	0.8836	0.8843	0.8849	0.8856
.951	.8863	.8870	.8877	.8883	.8890	.8897	.8904	.8911	.8917	.8924
.952	.8931	.8938	.8945	.8952	.8959	.8966	.8974	.8981	.8988	.8995
.953	.9002	.9009	.9016	.9023	.9030	.9038	.9045	.9052	.9059	.9066
.954	.9073	.9080	.9088	.9095	.9103	.9110	.9117	.9125	.9132	.9140
.955	.9147	.9154	.9162	.9169	.9177	.9184	.9191	.9199	.9206	.9214
.956	.9221	.9229	.9236	.9244	.9252	.9260	.9267	.9275	.9283	.9290
.957	.9298	.9306	.9314	.9321	.9329	.9337	.9345	.9353	.9360	.9368
.958	.9376	.9384	.9392	.9400	.9408	.9416	.9425	.9433	.9441	.9449
.959	.9457	.9465	.9473	.9482	.9490	.9498	.9506	.9514	.9523	.9531
0.960	0.9539	0.9548	0.9556	0.9564	0.9573	0.9582	0.9590	0.9598	0.9607	0.9616
.961	.9624	.9632	.9641	.9650	.9658	.9666	.9675	.9684	.9692	.9700
.962	.9709	.9718	.9727	.9736	.9745	.9754	.9763	.9772	.9781	.9790
.963	.9799	.9808	.9817	.9826	.9835	.9844	.9854	.9863	.9872	.9881
.964	.9890	.9899	.9909	.9918	.9928	.9937	.9947	.9956	.9966	.9975
.965	.9985	.9994	1.0004	1.0013	1.0023	1.0032	1.0042	1.0051	1.0061	1.0070
.966	1.0080	1.0090	1.0100	1.0110	1.0120	1.0130	1.0140	1.0150	1.0160	1.0170
.967	1.0181	1.0191	1.0201	1.0211	1.0221	1.0231	1.0241	1.0251	1.0261	1.0271
.968	1.0282	1.0292	1.0303	1.0314	1.0324	1.0335	1.0346	1.0356	1.0367	1.0378
.969	1.0389	1.0399	1.0410	1.0421	1.0432	1.0443	1.0453	1.0464	1.0475	1.0486
0.970	1.0497	1.0508	1.0519	1.0530	1.0542	1.0553	1.0565	1.0576	1.0587	1.0598
.971	1.0610	1.0622	1.0633	1.0645	1.0657	1.0668	1.0680	1.0692	1.0704	1.0715
.972	1.0727	1.0739	1.0751	1.0763	1.0775	1.0788	1.0800	1.0812	1.0824	1.0836
.973	1.0848	1.0861	1.0873	1.0886	1.0898	1.0911	1.0924	1.0936	1.0949	1.0961
.974	1.0974	1.0987	1.1000	1.1013	1.1026	1.1040	1.1053	1.1066	1.1079	1.1092
.975	1.1105	1.1119	1.1132	1.1146	1.1159	1.1173	1.1187	1.1200	1.1214	1.1227
.976	1.1241	1.1255	1.1269	1.1284	1.1298	1.1312	1.1326	1.1340	1.1355	1.1369
.977	1.1383	1.1398	1.1413	1.1427	1.1442	1.1457	1.1472	1.1487	1.1501	1.1516
.978	1.1531	1.1546	1.1562	1.1578	1.1593	1.1608	1.1624	1.1640	1.1655	1.1670
.979	1.1686	1.1702	1.1718	1.1735	1.1751	1.1767	1.1783	1.1799	1.1816	1.1832

TABLE 8.—*Backwater function (F) for a dam or obstruction*—Continued.

[The column headings are hundredths for values of $\frac{D}{d}$ from zero to 0.29, thousandths for values of $\frac{D}{d}$ from 0.30 to 0.899, and ten-thousandths for values of $\frac{D}{d}$ from 0.900 to 0.999.]

$\frac{D}{d}$	0	1	2	3	4	5	6	7	8	9
	F	*F*	*F*	*F*	*F*	*F*	*F*	*F*	*F*	*F*
0.980	1.1848	1.1865	1.1882	1.1899	1.1916	1.1934	1.1951	1.1968	1.1985	1.2002
.981	1.2019	1.2037	1.2055	1.2073	1.2091	1.2109	1.2127	1.2145	1.2163	1.2181
.982	1.2199	1.2218	1.2237	1.2256	1.2275	1.2294	1.2314	1.2333	1.2352	1.2371
.983	1.2390	1.2410	1.2430	1.2451	1.2471	1.2491	1.2511	1.2531	1.2552	1.2572
.984	1.2592	1.2614	1.2635	1.2656	1.2678	1.2700	1.2721	1.2742	1.2764	1.2786
.985	1.2807	1.2830	1.2853	1.2876	1.2899	1.2922	1.2945	1.2968	1.2991	1.3014
.986	1.3037	1.3062	1.3086	1.3111	1.3136	1.3160	1.3185	1.3210	1.3235	1.3259
.987	1.3284	1.3311	1.3337	1.3364	1.3391	1.3418	1.3444	1.3471	1.3498	1.3524
.988	1.3551	1.3580	1.3609	1.3638	1.3667	1.3696	1.3725	1.3754	1.3783	1.3812
.989	1.3841	1.3873	1.3905	1.3936	1.3968	1.4000	1.4032	1.4064	1.4095	1.4127
0.990	1.4159	1.4194	1.4229	1.4264	1.4299	1.4334	1.4370	1.4405	1.4440	1.4475
.991	1.4510	1.4549	1.4588	1.4628	1.4667	1.4706	1.4745	1.4784	1.4824	1.4863
.992	1.4902	1.4947	1.4991	1.5036	1.5080	1.5125	1.5170	1.5214	1.5259	1.5303
.993	1.5348	1.5399	1.5451	1.5502	1.5553	1.5604	1.5656	1.5707	1.5758	1.5810
.994	1.5861	1.5922	1.5983	1.6043	1.6104	1.6165	1.6226	1.6287	1.6347	1.6408
.995	1.6469	1.6543	1.6618	1.6692	1.6767	1.6841	1.6915	1.6990	1.7064	1.7139
.996	1.7213	1.7309	1.7405	1.7501	1.7597	1.7692	1.7788	1.7884	1.7980	1.8076
.997	1.8172	1.8307	1.8442	1.8577	1.8712	1.8848	1.8982	1.9118	1.9253	1.9388
.998	1.9523	1.9754	1.9985	2.0216	2.0447	2.0678	2.0910	2.1141	2.1378	2.1603
.999	2.1834	.....	.....	.....	.....	.....	.....	.....	.....	.....
1.000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE 9.—DISCHARGE OVER A THIN-EDGED WEIR BY BAZIN'S FORMULA.

By E. C. MURPHY.

Table 9 gives the discharge per foot of length over sharp-crested vertical weirs, without end contractions, of heights 2, 4, 6, 8, 10, 20, and 30 feet, computed from Bazin's formula. Although this formula is based on data obtained from experiments with heads not greater than 1.64 feet, discharges for heads of 4 feet and less computed thereby agree within 2 per cent with those obtained by use of the Fteley and Stearns formula. The discharge given by this table is corrected for velocity of approach and the head to be used is that observed 16 feet or more upstream from the crest of the weir.

This table is computed from the formula $Q=\left(0.405+\frac{.0984}{h}\right)\left(1+0.55\frac{h^2}{(p+h)^2}\right)Lh\sqrt{2gh}$, in which h=observed head, in feet; p=height of weir, in feet; L=length of crest, in feet; Q=discharge in second-feet.

TABLE 9.—*Discharge per foot of length over sharp-crested vertical weirs without end contractions.*[a]

h \ p	2	4	6	8	10	20	30
0.1	0.13	0.13	0.13	0.13	0.13	0.13	0.13
.2	.33	.33	.33	.33	.33	.33	.33
.3	.58	.58	.58	.58	.58	.58	.58
.4	.88	.88	.87	.87	.87	.87	.87
.5	1.23	1.21	1.21	1.21	1.21	1.20	1.20
.6	1.62	1.59	1.58	1.58	1.57	1.57	1.57
.7	2.04	1.99	1.98	1.98	1.97	1.97	1.97
.8	2.50	2.43	2.41	2.41	2.40	2.40	2.40
.9	3.00	2.90	2.88	2.86	2.86	2.85	2.85
1.0	3.53	3.40	3.36	3.35	3.34	3.33	3.33
1.1	4.10	3.93	3.88	3.86	3.85	3.84	3.83
1.2	4.69	4.48	4.42	4.40	4.38	4.36	4.36
1.3	5.32	5.07	4.99	4.96	4.94	4.92	4.91
1.4	5.99	5.68	5.58	5.55	5.52	5.49	5.48

[a] This table should not be used where water on the downstream side of the weir is above the level of the crest, nor unless air circulates freely between the overfalling sheet and the downstream face of the weir. If a vacuum forms under the falling sheet the discharge may be 5 per cent greater than given in this table.

TABLE 9.—*Discharge per foot of length over sharp-crested vertical weirs without end contractions*—Continued.

h \ p	2	4	6	8	10	20	30
1.5	6.69	6.30	6.20	6.16	6.13	6.08	6.07
1.6	7.40	6.97	6.84	6.78	6.75	6.69	6.68
1.7	8.15	7.66	7.50	7.43	7.39	7.33	7.31
1.8	8.93	8.37	8.18	8.09	8.05	7.98	7.96
1.9	9.74	9.11	8.89	8.79	8.74	8.65	8.63
2.0	10.58	9.87	9.62	9.51	9.44	9.34	9.32
2.1	11.44	10.65	10.37	10.24	10.17	10.05	10.02
2.2	12.33	11.46	11.14	10.99	10.91	10.78	10.75
2.3	13.25	12.29	11.93	11.77	11.67	11.52	11.48
2.4	14.20	13.15	12.75	12.56	12.45	12.28	12.24
2.5	15.18	14.03	13.59	13.37	13.25	13.06	13.02
2.6	16.17	14.92	14.44	14.20	14.07	13.85	13.80
2.7	17.19	15.84	15.31	15.05	14.90	14.65	14.60
2.8	18.23	16.79	16.21	15.92	15.76	15.48	15.42
2.9	19.29	17.75	17.12	16.81	16.63	16.32	16.25
3.0	20.38	18.74	18.06	17.71	17.52	17.18	17.10
3.1	21.50	19.74	19.01	18.64	18.42	18.05	17.96
3.2	22.64	20.77	19.98	19.58	19.34	18.93	18.83
3.3	23.80	21.82	20.98	20.54	20.28	19.83	19.72
3.4	24.98	22.89	21.99	21.52	21.24	20.75	20.63
3.5	26.20	23.98	23.01	22.51	22.22	21.69	21.55
3.6	27.42	25.09	24.06	23.52	23.20	22.62	22.48
3.7	28.67	26.23	25.13	24.55	24.21	23.58	23.43
3.8	29.94	27.38	26.22	25.60	25.23	24.56	24.39
3.9	31.23	28.55	27.32	26.66	26.27	25.54	25.37
4.0	32.54	29.74	28.45	27.71	27.32	26.55	26.35
4.1	33.87	30.96	29.59	28.84	28.39	27.56	27.34
4.2	35.22	32.18	30.75	29.96	29.48	28.59	28.35
4.3	36.59	33.43	31.92	31.09	30.58	29.63	29.38
4.4	37.99	34.70	33.12	32.24	31.70	30.68	30.42
4.5	39.40	35.98	34.33	33.40	32.83	31.74	31.47
4.6	40.83	37.29	35.56	34.58	33.98	32.82	32.53
4.7	42.28	38.61	36.80	35.78	35.14	33.92	33.61
4.8	43.75	39.96	38.07	37.00	36.32	35.04	34.70
4.9	45.23	41.32	39.35	38.23	37.52	36.17	35.80
5.0	46.73	42.69	40.65	39.48	38.74	37.21	36.91
5.1	48.25	44.09	41.96	40.73	39.97	38.45	38.03
5.2	49.79	45.50	43.29	42.01	41.20	39.61	39.17
5.3	51.36	46.93	44.64	43.30	42.45	40.78	40.31
5.4	52.94	48.38	46.00	44.60	43.71	41.96	41.47
5.5	54.54	49.85	47.38	45.93	45.00	43.16	42.64
5.6	56.15	51.34	48.79	47.27	46.31	44.38	43.83
5.7	57.78	52.83	50.19	48.62	47.62	45.60	45.02
5.8	59.42	54.34	51.62	49.99	48.94	46.83	46.22
5.9	61.09	55.88	53.07	51.38	50.29	48.08	47.44
6.0	62.77	57.43	54.53	52.78	51.64	49.34	48.67
6.1	64.46	59.00	56.00	54.20	53.02	50.61	49.91
6.2	66.18	60.58	57.50	55.63	54.40	51.90	51.16
6.3	67.91	62.18	59.01	57.07	55.80	53.20	52.42
6.4	69.65	63.79	60.53	58.53	57.22	54.50	53.70

TABLE 9.—*Discharge per foot of length over sharp-crested vertical weirs without end contractions*—Continued.

h \ p	2	4	6	8	10	20	30
6.5	71.42	65.42	62.07	60.01	58.65	55.82	54.98
6.6	73.19	67.07	63.63	61.50	60.09	57.16	56.27
6.7	74.99	68.74	65.20	63.00	61.55	58.50	57.58
6.8	76.80	70.42	66.78	64.53	63.02	59.96	58.90
6.9	78.62	72.11	68.38	66.06	64.50	61.23	60.22
7.0	80.46	73.82	70.00	67.60	66.00	62.61	61.56
7.1	82.32	75.55	71.63	69.17	67.52	64.00	62.91
7.2	84.18	77.29	73.28	70.74	69.04	65.40	64.27
7.3	86.07	79.04	74.94	72.34	70.58	66.81	65.64
7.4	87.97	80.81	76.61	73.94	72.14	68.24	67.02
7.5	89.89	82.60	78.30	75.56	73.70	69.68	68.41
7.6	91.82	84.40	80.01	77.19	75.28	71.13	69.81
7.7	93.76	86.22	81.73	78.84	76.88	72.59	71.23
7.8	95.72	88.05	83.46	80.50	78.48	74.06	72.65
7.9	97.70	89.90	85.21	82.18	80.11	75.55	74.09
8.0	99.68	91.75	86.97	83.87	81.74	77.04	75.53
8.1	101.69	93.63	88.75	85.57	83.39	78.55	76.98
8.2	103.70	95.51	90.54	87.29	85.25	80.06	78.44
8.3	105.73	97.42	92.34	89.02	86.72	81.59	79.92
8.4	107.78	99.34	94.16	90.76	88.41	83.13	81.40
8.5	109.84	101.27	96.00	92.52	90.11	84.69	82.90
8.6	111.91	103.21	97.84	94.29	91.82	86.25	84.41
8.7	113.99	105.17	99.70	96.07	93.55	87.82	85.92
8.8	116.09	107.14	101.57	97.87	95.28	89.40	87.44
8.9	118.20	109.13	103.46	99.68	97.04	91.00	88.98
9.0	120.33	111.13	105.36	101.50	98.80	92.61	90.52
9.1	122.47	113.15	107.28	103.34	100.58	94.23	92.08
9.2	124.62	115.18	109.21	105.19	102.37	95.86	93.65
9.3	126.79	117.22	111.15	107.06	104.17	97.49	95.22
9.4	128.97	119.27	113.10	108.93	105.99	99.14	96.80
9.5	131.16	121.34	115.07	110.82	107.82	100.80	98.40
9.6	133.36	123.42	117.05	112.72	109.65	102.48	100.00
9.7	135.58	125.51	119.04	114.64	111.50	104.16	101.62
9.8	137.82	127.63	121.05	116.57	113.37	105.85	103.25
9.9	140.06	129.74	123.07	118.51	115.25	107.56	104.88
10.0	142.31	131.87	125.10	120.46	117.14	109.27	106.52

TABLES 10–12.—MULTIPLIERS FOR DETERMINATION OF DISCHARGE OVER BROAD-CRESTED WEIRS.

By E. C. Murphy.

Tables 10 to 12 give multipliers to be applied to quantities in Table 9 to determine the discharge over broad-crested weirs of crest shape and height shown at the head of each column. Example: Suppose the discharge is to be computed over a rectangular weir that is 10 feet long, 12 feet high, 6 feet crest width, and has an observed head of 2.4 feet.

Table 9 shows that for a height (p) of 12 feet and a head (h) of 2.4, the discharge (q) is 12.42 second-feet. Table 10 shows that for a height (p) of 12 feet, a crest width (c) of 6 feet, and head (h) of 2.4 feet the multiplier is 0.797. Hence, the discharge is $12.42 \times 0.797 \times 10 = 99.0$ second-feet. With two end contractions the discharge would be 9.9 $\left(10 - \frac{2 \times 2.4}{10}\right) = 94.2$.

TABLE 10.—*Multipliers of discharge over rectangular weir, broad crested (type a, fig. 17, p. 191).*

[p=height of weir; c=width of crest; h=observed head; all in feet.]

h \ p.. / c..	4.6 2.6	4.6 6.6	11.25 .48	11.25 .93	11.25 1.65	11.25 3.17	11.25 5.88	11.25 8.98	11.25 12.24	11.25 16.30
0.5	.....	.....	0.821	0.792	0.806	0.792	0.799	0.801	0.786	0.790
1.0	0.765	0.708	.997	.899	.808	.795	.791	.794	.815	.790
1.5	.789	.709	1.00	.982	.878	.796	.796	.793	.814	.792
2.0	.814	.710	1.00	1.00	.906	.815	.797	.792	.797	.793
2.5	.835	.711	1.00	1.00	.985	.844	.797	.790	.796	.793
3.0	.857	.711	1.00	1.00	1.00	.870	.797	.788	.794	.791
3.5	.878	.712	1.00	1.00	1.00	.90	.812	.787	.794	.791
4.0	.899	.714	1.00	1.00	1.00	.93	.834	.786	.792	.789
5.0	.940	.716	1.00	1.00	1.00	.97	(a)	.78	.79	.78
6.0	.986	.718	1.00	1.00	1.00	.98	(a)	.78	.78	.78
7.0	.....	.....	1.00	1.00	1.00	(a)	(a)	.77	.78	.77
8.0	.....	.....	1.00	1.00	1.00	(a)	(a)	.77	.77	.77
9.0	.....	.....	1.00	1.00	1.00	(a)	(a)	.77	.77	.77
10.0	.....	.....	1.00	1.00	1.00	(a)	(a)	.77	.77	.77

a Value doubtful.

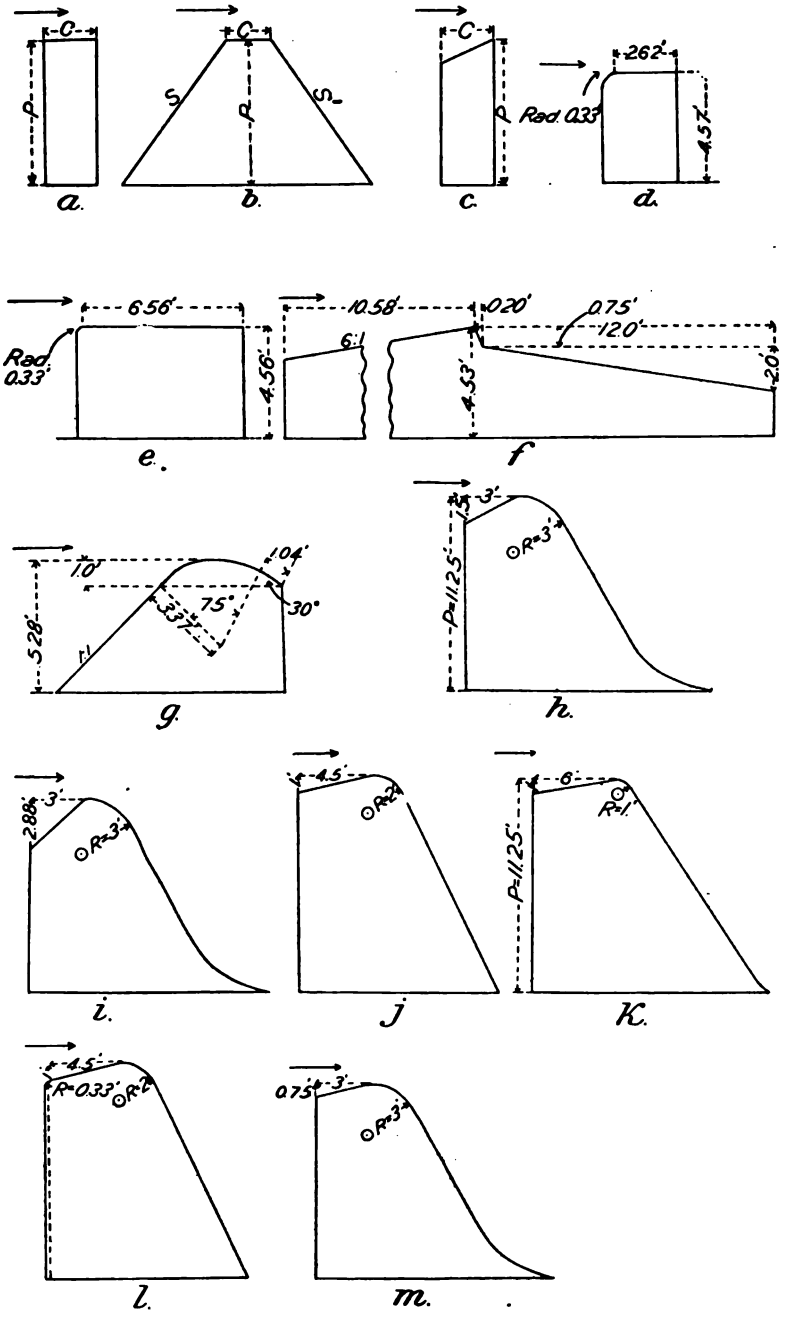


FIG. 17.—Types of weirs referred to in Tables 10, 11, and 12.

TABLE 11.—*Multipliers of discharge for trapezoidal weirs.*

[p=height of weir, in feet; c=width of crest, in feet; s=upstream slope; s'=downstream slope; h=observed head, in feet.]

	Type *b*, fig. 17.							Type *c*, fig. 17.	
p	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.65	11.25
c	.33	.66	.66	.66	.66	.33	.66	7.00	6.00
s	2:1	2:1	3:1	4:1	5:1	2:1	2:1	4.67:1	6:1
s'	0	0	0	0	0	5:1	2:1	.....	.....
h									
1.0	1.137	1.048	1.066	1.039	1.009	1.095	1.071	1.042	1.060
1.5	1.131	1.068	1.066	1.039	1.009	1.071	1.066	1.033	1.069
2.0	1.120	1.080	1.061	1.033	1.005	1.044	1.053	1.024	1.054
2.5	1.106	1.085	1.052	1.026	.997	1.024	1.047	1.012	1.012
3.0	1.094	1.088	1.047	1.020	.991	1.009	1.047	.995	.985
3.5	1.085	1.087	1.043	1.017	.988	1.003	1.050	.983	.979
4.0	1.072	1.084	1.038	1.012	.984	1.014	1.052	.977	.976
4.5	1.064	1.081	1.035	1.009	.980	1.023	1.055	.974	.973
5.0	.....	.....	.....	.....	.....	.....	.....	.97	.97
6.0	.....	.....	.....	.....	.....	.....	.....	.97	.96
7.0	.....	.....	.....	.....	.....	.....	.....	.97	.96
8.0	.....	.....	.....	.....	.....	.....	.....	.96	.96
9.0	.....	.....	.....	.....	.....	.....	.....	.96	.95
10.0	.....	.....	.....	.....	.....	.....	.....	.96	.95

TABLE 12.—*Multipliers of discharge for compound weirs.*

[p=height of weir, in feet; h=observed head, in feet.]

p	4.57	4.56	4.53	5.28	11.25	11.25	11.25	11.25	11.25	11.25
Type, fig. 17 (p. 191).	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*
h										
0.5	.....	.....	.....	.....	0.941	0.924	0.933	0.962	0.971	0.947
1.0	0.842	0.836	0.929	0.976	1.089	1.033	.988	1.045	1.033	1.000
1.5	.866	.834	.950	.979	1.087	1.093	1.018	1.066	1.042	1.036
2.0	.888	.831	.963	.988	1.109	1.133	1.033	1.063	1.035	1.063
2.5	.906	.826	.947	1.000	1.118	1.153	1.045	1.020	1.033	1.085
3.0	.927	.822	.942	1.016	1.120	1.163	1.054	.997	1.045	1.096
3.5	.945	.817	.936	1.032	1.127	1.169	1.060	.994	1.054	1.108
4.0	.965	.812	.931	1.044	1.123	1.165	1.060	.991	1.057	1.110
5.0	1.00	.80	.92	1.05	1.11	1.16	1.05	.98	1.05	1.10
6.0	.....	.....	.....	.....	1.11	1.15	1.01	.98	1.04	1.10
7.0	.....	.....	.....	.....	1.10	1.14	1.04	.97	1.04	1.09
8.0	.....	.....	.....	.....	1.10	1.14	1.04	.97	1.03	1.09
9.0	.....	.....	.....	.....	1.09	1.14	1.03	.97	1.03	1.08
10.0	.....	.....	.....	.....	1.09	1.13	1.03	.97	1.03	1.08

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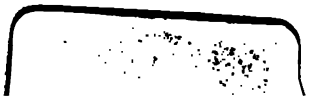
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